PSYCHOLOGY IN INDUSTRY

A PSYCHOLOGICAL APPROACH TO INDUSTRIAL PROBLEMS

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EDITOR'S INTRODUCTION

IN THIS BOOK, *Psychology in Industry,* Doctor Norman R. F. Maier has brought together the principal facts and theories of pure and applied psychology which are important in industry and business.

The way of life which has made America great in the past can continue to develop and bring prosperity and satisfaction to larger and larger numbers of people only if it can solve the menacing problems of this chaotic postwar world. Basic in almost all these great present-day problems are questions concerning the interactions of human beings. How can men and women who are called workers and men and women who represent management approach their joint tasks in a constructive spirit? How can men and women who are consumers and those who are producers of goods meet on a common human basis? How can urban industrial workers and farmers reconcile their conflicting objectives? How can individuals of different races, religions, and political backgrounds learn to work effectively with each other? How can individuals of differing abilities be most effectively selected and trained for work which is best fitted to them?

The questions just suggested are but a few among many which focus the attention of thoughtful men today upon human nature in action in our society. The student of this book will learn that psychology does not have readymade answers for all the problems which center about men and jobs or about the relationships of man to man in industry. On the other hand, there seems little doubt that an unbiased student who reads and studies the chapters of this book will realize that the material here presented is of basic importance in assisting him in understanding the new personnel problems of our age.

Today it is recognized in the design and development of new mechanical equipment that so-called practical men with "know-how" or a "knowledge of the art" based on apprenticeship and

long experience do their best work when co-operating with theoretically expert engineers, chemists, and physicists. A similar fruitful co-operative relationship is now developing between practical men in all aspects of personnel work and scientifically trained industrial psychologists.

The present book is not too technical for the student who has not had an opportunity to make a detailed previous study of psychology, but it is also not a false popularization. Its pages reflect the knowledge of a widely known and scientifically trained psychologist who has long professionally concerned himself with the human problems of industry.

Psychology in Industry is intended for a wide audience. It is a well-written book that will be of practical value for everyone whose life is even partly spent in work with other human beings.

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PREFACE

Psychology as a body of knowledge is utilized by a small proportion of industrial and business organizations. A few of these who have pioneered in the field of applied industrial psychology have set up large overall programs; others utilize psychological techniques only in certain departments, such as selection and promotion programs. Some have learned from experience that a consideration of employee's welfare is wise; some have benefited by news articles showing that rest periods pay dividends; and many have learned from engineers and other experts that good lighting, machine design, and job arrangement can increase production and reduce accidents. The large majority of the employers, however, have no [true] psychological programs at all.

Since human behavior is involved in many phases of industrial practice, it is the author's belief that a presentation of a brief nontechnical but systematic treatment of psychology and its bearing on industrial practice might be useful. Texts on industrial psychology which are primarily concerned with training psychologists for industry are too technical or detailed to be useful to the students training for industry and the personnel men, supervisors, and engineers. These groups are nevertheless in a position to benefit by a study of psychology in relation to industry in terms of basic concepts and general principles.

In order to attain the objective of readability, this book has a minimum of references. Experimental studies are cited only when such typical illustrations are necessary to clarify principles; when credit must be given to authors who pioneered in the discovery of important contributions in industrial psychology; and when original material has been taken from general experimental psychology and for the first time applied to psychological problems in industry. At points where controversial or complex techniques are discussed the author has indicated sources where a more detailed treatment may be found.

To achieve the objective of a systematic treatment, an attempt has been made to integrate the laboratory and industrial studies. Psychology as a science is related to applied psychology in much the same way as physics and chemistry are related to the techniques of engineering. In the last analysis the science and its application must be consistent. To attempt to develop an applied field into an independent body of knowledge is to lose sight of the importance of systematization in arriving at principles. Further, this practice tends to reduce the possibility that the pure science may make a direct contribution to practice. As physics may directly contribute to industry so some aspects of experimental psychology may be useful to the handling of human problems in industry.

In this book emphasis has been placed on the problems of morale, attitude, and motivation. These fields have been investigated by social and experimental psychologists and have been given limited attention in other treatments on industrial psychology. That these are vital problems to modern industry has become more and more apparent and their fundamental importance arises from the fact that they affect the worker's behavior, thinking, and efficiency; labor legislation, and the nature of our government and social order. The treatment in the present volume is characterized by the fact that these topics permeate the whole organization of the material. In this sense the volume is controversial. Although the author believes he has been guided largely by psychological considerations, nevertheless his emphasis on certain subjects may make him appear critical of some industrial practices which now dominate. This bias the author admits. He believes mistakes in policy have been made and are being made, and that democracy will suffer if short-sighted attitudes and interests prevail. Problems in taxation, labor legislation, the prerogatives and rights of management, and the organization of foremen's unions are sources of conflict and cannot be solved satisfactorily by a test of strength.

Such topics as employee selection and testing have been treated relatively less extensively than in other books on applied psychology. Excellent treatments of these subjects are available which are of primary interest to the specialist in industrial psychology. However, the purposes and accomplishments of testing techniques and the relationship of a selection and promotion program to employee morale are of interest to all who are concerned with industrial policy and efficiency.

Relatively detailed treatment has been given to such subjects as motivation, fatigue, and accidents because these topics are of general interest to the non-psychologist, and many of the principles can be understood and applied without a background of specialized training in psychology.

Since this volume is primarily intended for the many who are concerned with human problems in industry and who themselves are not industrial psychologists, it may serve as a textbook for beginning courses in applied psychology which are designed for students who do not intend to become industrial psychologists, but who wish a practical course in psychology. The author has in mind students in engineering, business administration, as well as those in the liberal arts college who wish to supplement their specialized training in such related subjects as economics, sociology, and political science. For psychology majors the book may serve as an introduction to, but not as a substitute for, standard courses in industrial psychology. Training in industrial psychology should include a liberal background in experimental and social psychology, courses in testing and test construction, a basic course in statistics, as well as courses in different phases of industrial psychology.

The selection and emphasis of materials for this book are based on many years of experience in teaching college sophomores and juniors in a course on the psychology of management (for which there is a complementary course in selection and interviewing techniques); the teaching of four groups of men and women in a

War Training Program in Detroit and subsequent experiences in introducing a supervisory training program in a large industry. It was the responsiveness and enthusiasm of the industrial groups for psychological analysis of industrial problems that stimulated the author to make this material available to others.

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1 INTRODUCTION

SCIENCE IN INDUSTRY

THE PRESENT ERA in industry may be regarded as the period of transition from the machine age to the scientific age. The important factor in this transition is the increasing appreciation of the value of the sciences to industry. New products, more economical ways of making old products, and substitutes which are better than the originals are promised during the coming "age of miracles." Science is extending itself beyond the confining walls of the laboratory, and the common man looks to it in hope. No longer is it considered something remote and mysterious. More and more, industry is employing men trained in engineering colleges to solve problems which were formerly solved by trial-and-error procedures. Trial and error is often slow and expensive, but, with the application of scientific methods, results can be predicted by calculations and theoretical developments. Thus progress can be hastened.

Even at the operational level, industry now finds it necessary to use technically trained workers as a result of the increased use of intricate equipment. Technical schools are called upon to furnish some of these trained workers, but many industries find it necessary to train their own men in certain operations. Technical knowledge, rather than experience, has thus become the important factor in placing, as well as in advancing, men into the more technical jobs.

As a result of the emphasis on technical developments, we hear more about theory and less about "common sense." However, until theories are put to work, they remain abstractions; it was not so long ago that we associated them with the "ivory tower" of the university atmosphere. The theoretical man, therefore, was often thought to be impractical, whereas in reality he often was a man who had not put his theories to work. Many theories in the physical sciences have now passed the stage of the cloistered atmosphere, and the engineer applies the theories of physics and chemistry in many phases of industry.

The theories and principles of psychology, however, have not reached this advanced stage of acceptance and many of the potential applications of psychology remain to be made. Common sense, therefore, is still a frequent substitute for scientific psychology in dealing with problems having to do with people. There is evidence, however, of a growing interest among practical people in the subject matter of psychology.

The machine age represented a great change in the production of goods. It was characterized by the use of motors to furnish power, and, with its development, motor power rapidly replaced manpower. Since machinery of various forms was needed to utilize this new type of power, complex machines replaced the tools with which man previously worked. The power-driven machinery naturally became located in plants owned by the employer. This development gradually separated labor from the tools of labor and resulted in the centralization of industry. The means of production thus became controlled by fewer and fewer individuals, who employed larger and larger numbers of men. This industrial trend led to a shifting of the population from rural areas to centers of production which became our industrial cities. With this centralization of industry, there came a complete change in the economic and social aspects of living.

The scientific age carries this trend even farther. Industry is becoming more and more the determiner of our way of life.

Whether it will bring about a better or poorer way of life depends upon what industry does with its influence and power. If it brings about a poorer way of life, it will destroy itself in the end, even though it may use its power for purposes of self-defense and survival. If, on the other hand, industry assumes responsibility for bringing about a better way of life and is aware of social trends and human needs, it will strengthen its position and leadership.

The most undeveloped aspect of industrial progress is management of labor power, an aspect which must be considered seriously in the scientific age. Men cannot be eliminated from industry. The use of engineering science will merely make it possible for each man to produce more with the machinery that he controls. Even if man could be replaced by machines, industry would accomplish only self-destruction because it would thereby eliminate its market. There would thus be no point in entirely replacing men with machines, even if it were possible.

The rapid developments in industry have gone forward without a sufficient awareness of human problems because the emphasis has been placed on production methods. Technically trained men are invariably put in charge of machines, but often untrained supervisors are regarded as qualified to be in charge of men. The nature of man is far more complex than that of the most elaborate machine, yet men are sometimes supervised by experts in machinery rather than by men with training in the fundamentals of human behavior. We may expect a trend in the near future toward training supervisors in some of the basic principles of psychology.

It is a rather common belief that the ability to handle men is inborn, and that nothing can be done about it except to try to find men who have this native ability. Without question, there is some truth in this opinion. It is equally true that some men have a natural knack with machinery, yet one would not wish to contend that a master mechanic is born and not made. Training will greatly extend a man's interests and aptitudes in handling machin-

ery, and the men having these traits to the greatest degree will profit the most. Likewise, training in the handling of men will improve ability along these lines. Everyone can improve, but all cannot become equal in ability as a result of training. It does not follow, however, that ability to handle men is purely a matter of training. It is, therefore, necessary to debunk another common belief — that experience is the sole factor in ability to manage workers.

Ordinarily, one improves the abilities one has with experience, but unsupervised experience has definite limitations. A man's game of golf improves with practice, but, if his activities are supervised by a coach, he improves more with the same amount of practice. Experience and training differ in the same way that unsupervised practice in golf differs from supervised practice. We cannot assume that a man is highly capable of handling men just because he has done so for the past ten years. We can tell from his record whether or not his performance has been satisfactory, but even a satisfactory performance may fall far short of what it might have been. Progress is made by constantly raising our standards of performance. Certainly our standards of employee attitudes and ability to co-operate will rise with increased training in supervision and with more adequate knowledge of the factors which influence morale.

PSYCHOLOGY, THE SCIENCE OF MAN'S BEHAVIOR

If the study of human beings is important to business practice, one may wonder why many employers have overlooked its possibilities. A few industrial firms have done pioneer work in some aspect of applied psychology, but the majority have shown little or no inclination in this direction. Most of the applications of psychology have been confined to the selection of personnel, although recently considerable interest has developed in its application to job analysis. In this field, a number of companies are now carrying on extensive programs.

In general, the main types of psychological problems in industry are handled with widely varying degrees of awareness on the part of the employer. The importance of attitudes has long been apparent in labor strife, but very few companies have seen it as a problem for psychological investigation. The shortage of labor has forced many companies to make concessions to women workers and these concessions have often been found to increase efficiency of production. A report of the War Manpower Commission points out that business organizations which are comparable in everything but morale show wide differences in the cost of producing the same product. Firms which have undertaken programs to develop morale have been able to reduce their costs considerably below those of firms which have ignored this factor.[1] That such a discovery should have been made from practical experience and was not predicted shows that recent psychological developments have not been publicized.

A little thought on this question reveals that this failure fully to appreciate the human element in industry is not too surprising after all. In our dealings with men we have tended to take the men themselves for granted. Because we have been with people all our lives, we are so used to them that we overlook them as subjects for study. In like manner, the child of today has little curiosity about the radio; he has always known it and takes it for granted. However, when the radio first appeared, it was something that had to be explained. It did not fit with previous experience and so aroused curiosity. Thus, it often happens that we know more about things remote from our everyday lives than we do about the near-by common objects.

Psychology is a relatively new science, largely because its subject matter is so common that it escaped attention. Men have always lived together and influenced one another. Some get along together and share their worldly possessions; others are in constant conflict and deprive each other of worldly possessions at

[1] *Newsweek*, 1943, *22*, November 1, p. 18.

every possible opportunity. That such things occur is said to be due to human nature. It is sometimes argued that war can never be abolished because it is human nature to fight. But even if man's desire for peace dominated over his belligerent impulses, we should still have wars because it is also man's nature to be contradictory in his impulses. Man may want peace and at the same time desire a high standard of living. To attain the latter, he strives for world markets, and this leads to war. The fact that the situation and not the nature of man is responsible for these contradictory activities is overlooked.

In industry, some men are employers and others are employees. That some have power and influence over others is taken for granted. If one man pays another, he has a right to demand services. If he does not receive the services he demands, he objects to human nature and may set out to change it. He feels that he has a right to demand human nature to be what he expects it to be.

The term *human nature* is a screen to hide our ignorance about man in general. People know each other by having observed each other's activities under limited conditions. They know from experience, for example, that some men pay their bills promptly and that others do not. These differences in behavior are associated with the individuals, while the situations in which the activities occur are almost entirely disregarded. From experience with people, one learns to know them as individuals, but one gains little knowledge of the general psychological principles of behavior. In a similar way, one may know the idiosyncrasies of one's car without knowing the principles by which it operates.

The nature of the relationships between employer and employee grew out of a situation in which a personal contact was present. Each knew the other intimately, and from experience each learned what he could expect from the other. This personal knowledge was a workable substitute for psychology.

The changing industrial methods have altered the nature of the

relationship, however. The disappearance of the personal contact between employer and employee has made it impossible for one to know the other intimately. As a consequence, they no longer deal with firsthand knowledge of each other. It, therefore, becomes more necessary to know about people in general. When we deal with large groups, we must concern ourselves with general principles. For example, I may know from past experience that a certain board is strong enough to support my weight. If, however, I must work with many boards, I must be able to utilize certain principles on which to base my judgments of the strength of boards in general. Similarly, I may know that John Smith will do a good day's work, but this does not help me to know what to expect of fifty men who apply for a job. In order to appraise the possibilities of these men, I must know something about man in general.

As a further example, let us consider the case of an employer who finds that his men are suspicious of the reforms and changes which he introduces. They invariably suspect ulterior motives, regardless of his real intentions. Formerly, when he worked in close contact with his men, this suspicion did not arise. Although his motives may not have changed in the meantime, the distance between himself and his employees has changed as his factory became larger. What can he do to retain their confidence when the social distance between him and his employees has increased? Are there methods of dealing with employees that breed suspicion and others which are conducive to confidence? To find answers to these questions he must have principles to guide him, since personal contact no longer serves the function of interpreting his intent.

SOURCES OF ERROR IN JUDGMENTS OF HUMAN NATURE

In dealing with human beings, we are inclined to overlook the fact that man's behavior is a subject for investigation. We do not appreciate that his actions are caused by things outside himself as

well as by forces within himself. Instead, we blame him for his actions, on the assumption that he is responsible and could do differently if he so willed. Actually, from a psychological point of view, we know that all behavior is *caused*, as we shall see in our discussion of this subject in Chapter 2. Since this is true, we must recognize that, no matter what a man does, he does it for good and sufficient reason. When we change the reason for, or the cause of, his behavior, then, and only then, will his behavior change. Instead of seeking causes, however, when things go wrong, we usually blame someone, and thereby, sometimes unconsciously, attempt to protect ourselves from criticism for perhaps having helped to bring about the undesirable results. It is plain that this natural reaction is not the correct or scientific approach to an understanding of human nature. In fact, by blaming, we merely avoid the issue. The solution to the problem of undesirable behavior is to find the causes of that behavior and then to remedy the situations which constitute those causes.

Even after we recognize that man's behavior is a subject for investigation, we are inclined to oversimplify the problem. We feel that we know something about the subject, since we are human beings ourselves and have had intimate contact with other human beings. From these general experiences of being human and knowing human beings, we build up certain general impressions which we call *common sense.* Some of these impressions are based upon sound observations, but others are inaccurate and hence misleading. The misleading impressions become handicaps because they lead us to believe that we know things which we do not know. They thus interfere with our acquisition of knowledge about human behavior.

Another source of error lies in our tendency to judge others by ourselves. This procedure is entirely unsound because we frequently do not know why we ourselves do things. This means that we are subject to errors when we judge ourselves. But suppose we know ourselves well enough to get by. Will this help us

to understand another and so to pass judgment on him? The probabilities are that such knowledge will not help to any appreciable degree. How can I, an employed man, say what an unemployed man should do? We are in different situations, have had different backgrounds, and have different heredities. As a consequence, our behavior must be different. We cannot blame a man for not behaving as we wish him to any more than we blame a machine for not functioning as we wish it to. As soon as we recognize causation, then the question of blame disappears. When the machine ceases to function, we look for the trouble; when we do this, there is a good chance that the machine will be repaired. The same approach should be applied to the behavior of man.

A third source of error arises when we judge man on the basis of our own observations of other men. It is true that we learn about men by the study of men, but our personal experiences are likely to be uncontrolled observations. The formulation of the laws of gravity was based upon controlled observations, not on casual experiences with falling bodies. Casual observation would lead to the belief that the action of gravity on falling feathers is different from that on falling stones. The error arises from the fact that the casual observer, not taking into account the influence of the buoyancy of the atmosphere, compares falling bodies which are acted upon to different degrees by the atmosphere. Before the true influence of gravity can be detected, the influence of the atmosphere must be controlled.

The scientific study of human behavior, like any other scientific study, requires that proper experimental conditions be satisfied. These conditions include the setting of a definite problem, observation and measurement of the factor studied, variation and control of experimental conditions, control of extraneous conditions, and recording and comparing data so that conclusions may be drawn. An example of an industrial study which meets these conditions may be found in Chapter 3, pages 33–38.

Failure to meet such conditions may lead to incorrect conclu-

sions. For example, suppose that in a plant where women are employed as welders, the man who supervises them may conclude from his experience that they are superior to men in industrial work. It must be granted that his experience is very limited. On a different job they may be distinctly inferior. Further, he has not selected them on the same basis as he has his men. The men available may be inferior workers, while the women who volunteer their services may be the best group of women workers for such work. It is also possible that women will not continue to function in a superior fashion, doing so now only because of interest and enthusiasm for the new rôle. The employer may even see the women through rose-colored glasses and be less critical of them, either because he likes them, because he does not expect as much of them, or because they are unlikely to compete with him for his position. These and many other factors were not considered in his casual observations.

There is no simple solution to the study of man. As in any science, advances in knowledge can be made only through experimentation and controlled observation. Psychology, as the science of man's behavior, must have much more than common sense to offer if it is to make its contribution to industry.

GENERAL PSYCHOLOGICAL PROBLEMS IN INDUSTRY

Man's behavior plays a part in all phases of industry. This means that psychological problems permeate all its aspects. Industrial strife, morale, and attitudes are responses which men make to their working conditions, and they directly influence the way in which labor will work and co-operate with management. These behaviors are merely symptoms; their causes precede their expression. Principles which relate behavior symptoms with their causes must obviously be psychological in nature.

The problem of fitting men to jobs requires that we know how to analyze abilities, and this is purely a psychological problem. To make the proper fit, however, the job must also be analyzed so

that we know what abilities to look for. If the abilities required for a particular job are too complex, the psychologist may co-operate with the engineer in reorganizing the work so that the job is redesigned to utilize to a greater degree the abilities that are available.

Teaching or training men for jobs is another purely psychological problem, one which calls especially for a knowledge of the subject of learning. Improving a man's adaptation to his work, increases both his efficiency and his satisfaction with his job.

The will to work is largely a psychological problem. The economic incentive of wages is not sufficient to gain co-operation, for the will of man cannot be bought so cheaply.

The problems of fatigue and boredom are both physiological and psychological in nature. A utilization of the laws describing their function is directly related to morale and production. How to do more work with the same amount of energy is an industrial problem which must be solved by men with scientific knowledge of the subject.

Even the problem of industrial accidents has a psychological aspect. The engineer may design safety devices, but he must so design them that the men will use them. Nor will such devices alone solve the accident problem. Some people will have accidents despite all mechanical precautions. Safety habits and proper placement of men are psychological tools for accident prevention.

Finally, the reactions of the worker to such factors as lighting, ventilation, sanitation, and noise pose problems for the industrial psychologist. Such environmental factors have definite effects on a man's performance on a job. They are conditions to which a man reacts and which influence his degree of fatigue, his motivation, and his attitude.

The application of psychology to industry must concern itself with these problems. Enough is known to make direct application possible in many instances. In others, the awareness of the prob-

lems will stimulate essential research and lead to rapid strides toward their solution. Only through the co-operation of industry and science can the vast possibilities of industrial development reach their greatest fulfillment.

INCIDENTS AND SPECIFIC PROBLEMS REQUIRE SPECIALISTS

In order to handle disputes between management and labor or between different factions of labor, various practices and procedures have been introduced from time to time. The procedure may represent an agreement between the union and management or it may be prescribed by law. The natures of the procedures naturally develop with the times and vary somewhat from one section of the country to another. The labor panel is an example of one of the present procedures.

Since the solution of specific disputes has legal as well as other implications, the study of procedures and policies is a large subject in itself and will not be discussed in this book. Books on personnel management and industrial relations may be consulted for information in this field.[2] The existing techniques and procedures for handling grievances and incidents in industry have been developed through experience and social pressures, and no particular individual can effectively alter them to suit his own purposes. They represent a framework within which conciliation must work.

Limitations of this sort do not conflict with our purpose, however, because a dispute is always a special case, while our problem is to suggest principles which tend to reduce the frequency with which such incidents occur. Once a dispute arises, it becomes a problem to be solved and its solution requires consideration of many factors. It is true that psychological principles and particular personality differences are involved, but these psychological factors must be fitted and applied to the special conditions. In a similar way, a doctor applies scientific principles in diagnosing and treating a patient's illness, but he must also take into

[2] D. Yoder, *Personnel Management and Industrial Relations*, pp. 640–702.

account a large number of other variables. The consideration and evaluation of these variables make the practice of medicine an art as well as a science. In arbitrating special cases in labor disputes the emphasis is on finding the principles which apply and giving them their proper evaluation. This supplementation of knowledge with judgment makes arbitration an art as well as a science. As in law, the dispute is usually decided in terms of a *just* settlement.

Incidents and grievances always have a background, however. Whether a group will overlook a foreman's action in discharging a workman or take sides with the man and go out on strike in protest depends on preceding conditions. Similarly, whether or not management will make an issue out of a smoking incident depends upon a chain of antecedent events and union agreements. Our problem in the present treatment is to emphasize the background conditions, since these are the underlying causes of incidents. An understanding and application of the principles which lead to co-operation will reduce troublesome incidents. This is the procedure of prevention rather than cure.

Another group of problems not included in our discussions are those arising in connection with individual conduct. There are always a certain number of persons who are badly adjusted and find it difficult to get along anywhere. Such persons require help from a skilled psychiatrist or clinical psychologist. Although the application of sound labor procedures will reduce this number, the maladjusted employee will still remain a special case and require individual treatment.[3]

Our concern is primarily with general trends and with a consideration of the factors and principles which influence behavior, provided other conditions are relatively constant. An understanding of general principles is the first step in the psychology of behavior, for their application may be expected to influence behavior in general.

[3] V. E. Fisher, and J. V. Hanna, *The Dissatisfied Worker*, pp. 169–235.

2 CAUSATION IN BEHAVIOR

THE PSYCHOLOGICAL APPROACH

INTRODUCTION

For a full appreciation of the applications of psychology to the various problems confronting industry, it is desirable that we have some understanding of the premises from which psychologists work. These premises are the outgrowth of many experiments and systematic observations.

From its beginning as a branch of philosophy, psychology has established itself as an independent science. Like that of all sciences, its aim is to reduce all phenomena to cause and effect. As the experimental approach became a more dominant influence in psychological thinking, the emphasis on the subject matter of psychology gradually shifted from mind to behavior. Because the behavior approach has been found to be more fruitful than the mentalistic approach and, at the same time, to accomplish the desired results in our understanding of man, we shall here deal with the question of what men do and why they do it rather than go into a lengthy discussion about the makeup of mind and consciousness. The behavior of man and his adjustments to the world will be our subject matter in general. How he behaves in the industrial scene as a worker, a social being, and a member of a union will be our subject in particular.

THE ORDER OF EVENTS LEADING TO BEHAVIOR

The first assumption made by a psychologist when confronted with a problem is that the behavior in question is caused. This

means that he does not pass judgment or blame a person for his actions, since to do so would be to assume that the person could have done otherwise. Causation implies that a given individual in a given situation must do as he does. In doing so, however, the person may experience unpleasantness, and this experience may so modify him that he will not repeat the action. If our blaming him prevents a repetition of an undesirable act, it has its value, but more will be gained if we understand that, in correcting an individual, we are guarding against a repetition rather than punishing for the past behavior.

If we accept the principle of causation, it follows that in antecedent events, not in accomplishments, lie the reasons for a given kind of behavior. Antecedent events are forms of stimulation which, when applied to the person, lead to behavior. The behavior may accomplish something by getting a man out of a difficulty, but this accomplishment is the product of, not the reason for, the behavior. The formula below describes the causal sequence:

$$\text{Stimulus} \longrightarrow \text{Organism} \longrightarrow \text{Behavior} \longrightarrow \text{Accomplishment}$$

According to this formulation, we read that the stimulus acts upon the organism, giving rise to behavior. Thus, a pin-prick applied to a person makes him jump. By jumping, he gets away from the pin, and this escape is an accomplishment. To say the man jumped because the pin hurt, or because he wanted to get away from the pin, is contrary to fact. It is known that the jumping from the pin-prick is a response to nerve energy released by the pin and that this energy is transmitted to muscles which contract and bring about the jump. The nerve energy also goes to the brain, bringing about the experience of pain. We therefore find that the same pin-prick is the cause both for the jump and for the pain. As a matter of fact, we jump before we experience the pain. In cases of brain injury, the pain may be entirely absent, but the injured person still jumps when pricked. In cases of paralysis, the

person does not jump, and yet he may experience the pain. Thus, we see that to say we jump because of the pain is quite misleading.

That we get away from the pin by jumping shows that such a response is a useful, protective reaction which helps us to survive, but this accomplishment is an end product. The experience of pain, however, is essential to learning, for because of it we may, on later occasions, avoid the person who applied the pin-prick. In such a case, the person is the stimulus to which we, as organisms, modified by the previous experience of pain, respond by running away before we are pricked.

The above formulation may seem simple and true enough, yet it immediately conflicts with common sense. We can no longer say, for example, that a chicken crosses the road in order to get on the other side. Getting on the other side of the road is the result of behavior. Certainly, the result or accomplishment of behavior cannot be the stimulus of that same behavior. This analysis of the chicken's behavior implies purpose, and purpose is that which is accomplished by behavior rather than the cause of that behavior. The same is true of the statement that squirrels bury nuts in order to have food for the winter. Having food for the winter is obviously the result of burying nuts and, consequently, cannot, at the same time, be the cause or reason for burying nuts.

Studies of the behavior of animals have clearly shown that the purposefulness of such behavior has been read into it by human beings who observe the adjustments which the animal accomplishes. They then assume that the making of these adjustments must have been the reason for the behavior. That such is not the case has been shown by experiment. For example, it has been shown that birds migrate in response to the length of day, not because of climatic conditions. By artificially changing the length of day, the migration behavior can be disturbed or even reversed. The study of migration behavior thus requires (1) determination of the nature of the stimuli which act upon the animal, and (2) observation of the changes which this stimulation

produces in the animal. That the migration results in survival is quite incidental and certainly is not part of the explanation.[1]

When we regard behavior as a function of the stimulation and the nature of the individual, it follows that alterations in behavior can be accomplished either by changing the stimulation or by changing the person. Suppose employees in the billing department of an office make mistakes. Are their errors caused by the way the job is set up or are they the result of behavior characteristics of the persons? Perhaps better lighting will increase accuracy; perhaps the presence of a more congenial supervisor will reduce errors. These would be changes in the stimulus. The errors may also be caused by faulty methods of work. Modifying the individuals by training them in certain work methods might solve the problem. Finally, the persons may have little aptitude for figures. If such is the case, the proper selection of employees would reduce errors. The corrective measure must attack the cause, and the remedies for altering the situation obviously differ from those of altering the person.

INTERACTION BETWEEN THE PERSON AND THE SITUATION

The discussion thus far applies to many simple situations and adequately describes the relationship between cause and purpose. It has also shown that both the individual and the situation are factors in determining behavior. Nevertheless, we must now point out that the formulation which we have given is oversimplified. Ordinarily, the individual is exposed to a large number of stimuli. The weather may be humid, the work may be monotonous, the hours may be long. When the supervisor tells a man to hurry, the employee's response may be the effect of the supplementary stimulating conditions as well as of the words. In any given situation, a person may react to a certain combina-

[1] An elementary account of migration is given in L. W. Crafts, T. C. Schneirla, E. E. Robinson, and R. W. Gilbert: *Recent Experiments in Psychology*, chap. 2, pp. 11–24.

tion of stimuli; which combination it happens to be depends upon his nature and condition at the moment. He not only determines, in part, what aspects of the situation will dominate, but to a great extent he influences the nature of things to which he reacts. For this reason, we must complicate our formulation by describing the stimulus as a stimulus-situation. Further, we must include in our formulation, not only the fact that the stimulus acts on the person, but that the person influences the stimulus. These added conditions are incorporated when we write the formulation as follows:

Stimulus-Situation $\longleftrightarrow$ Organism $\longrightarrow$ Behavior $\longrightarrow$ Accomplishment

Behavior now becomes the product of an interaction between the stimulus-situation and the organism.

We speak of the *interaction* between the stimulus and the organism because the condition or nature of the organism may influence the stimulus as well as be influenced by it. The sight of food is different for a hungry man from that for a sick one, because the supplementary stimulations in the body alter the properties (for the men) of the external stimulus. It is necessary, therefore, to distinguish between the physical properties of a stimulus and the properties it has for the organism. If a person experiences a stick of wood as a snake, we can best understand that person's behavior if we regard a snake, rather than a piece of wood, as his stimulus. Since the organism contributes something in determining the nature of a stimulus, we speak of an interaction between the stimulus and the organism rather than of a reaction of the organism to the stimulus. The product of this interaction in psychology is called *perception.*

The importance of this interaction will readily be recognized when we consider how different employees react to a certain supervisor. Some resent his presence because they see him as a slave-driver; others may take him as he is and overlook his remarks

because they see him as a nervous, hot-tempered person; while still others may be glad to have him around to help them and regard him simply as a person who is doing his job. The supervisor may consider himself a good-hearted fellow who is taking the interests of his men too seriously, and believe that he really should have a little more respect and co-operation for his efforts.

Although the conduct of the supervisor will influence the way men experience him, it must be recognized that the same supervisor is not the same stimulus for all people, even when he treats them alike. How men will see him may also depend upon the temperature (supplementary stimulation), the state of fatigue (a change in the organism), previous contacts with the supervisor and other supervisors (past experience), and the employee's personality (the basic nature of the organism). All these factors are implied when we speak of behavior as the product of an interaction between the stimulus and the organism.

PURPOSE IN THE BEHAVIOR OF MAN

In the study of the behavior of man we have the picture further complicated because man can tell his reasons for doing things. These reasons may be thought of as his purpose, but it is more accurate to speak of them as his anticipated accomplishments. For instance, if a man runs, and gives as his reason for running the desire to catch a train, we recognize that he anticipates that running will get him to the station on time. We also recognize that he has a need for a train. Both the need for the train and the anticipation of catching it are caused, however. On the one hand, the man needs the train because of the situation in which he finds himself. In other words, this need is the result of the man's stimulation. On the other hand, his anticipation is the product of past experience from which he has learned that running saves time and that trains arrive at certain times. In this sense, the anticipation is also caused. When we appreciate the fact that both anticipated results and needs are caused, we

must grant that what man calls his purposes or his reasons for behaving are not free choices, but rather are conditions and experiences which are determined by stimulation and by the nature of the organism. The obvious conclusion, then, is that alterations of behavior can be achieved only by a manipulation of the factors which cause behavior. This means that the behavior of the coward, as well as that of the hero, is caused and is not purely the responsibility of the individual in question.

THE BASIC CAUSES OF BEHAVIOR ARE OFTEN UNKNOWN TO THE INDIVIDUAL

Although the expressed explanation of behavior may reveal a man's anticipations and desires, his *account* of his responses may be quite incidental or even inaccurate. The important causes of behavior are often unknown to the individual, since they do not reach the level of consciousness. A person who fears snakes seldom knows why he does so. The fear may have its origin in an incident in early childhood. The incident is forgotten, but the fear of the snake which the incident generated remains. As another example, we may take the case of a man who attributes a decline in his productive ability to fatigue, while the real reason may lie in the fact that his morale is at a low level.

In other cases, people may think they know the *why* of the action and be entirely mistaken. For example, a group of men may say they are out on strike for the purpose of getting higher pay. They may accomplish the pay increase, but it still may be true that low pay was not the cause of their striking. Under other conditions of work, the same group may not have gone out on strike. Clean toilets, sanitary drinking fountains, security in their jobs, and sympathetic consideration of their problems may prevent men from striking for higher pay. On the other hand, unsatisfactory working conditions may make men so dislike a job that they demand higher wages if they are to continue to work. It is not always the poorest-paid groups who strike, a fact which

sometimes puzzles the employer. It is not unusual to find that men will actually leave jobs in one firm for lower-paying jobs in another firm. One cannot find the cause of such behavior merely by analyzing demands or expressed purposes. These demands are responses made to some kind of stimulation, and the effective stimuli may not even be known to the individuals who make the demands.

That people frequently do not know the cause of their disputes was clearly shown by an intensive investigation of factors associated with marital happiness.[2] This study revealed that one of the most important factors associated with unhappy marriages was an unhappy childhood. Unpleasant childhood experiences tend to create a feeling of insecurity, and with such a background proper emotional adjustments are never acquired. As a consequence, such children tend to grow into adults who are unable to make the necessary marital adjustments. Money, religion, sex, number of children — in other words, all the things married people quarrel about — were shown to be relatively unimportant.

When people do not get along, they quarrel about almost anything, and what they quarrel about is not necessarily the basic cause of the trouble. People who are not congenial will always find something to bicker about. The important thing is to get at the cause of the lack of congeniality. The bickering will then take care of itself. Investigations of this sort of problem clearly show that actual causes may be unknown to the individual and that these causes frequently go back to situations which are entirely unrelated to a present difficulty. A supervisor will readily recognize among his employees a few individuals who always have something about which to complain. These are poorly adjusted individuals, whose complaints are symptoms rather than descriptions of grievances.

[2] L. M. Terman, *Psychological Factors in Marital Happiness*, pp. 368–374.

EXCUSES ARE NOT CAUSES

Many so-called purposes or reasons for behavior are justifications or excuses rather than causes. A man may give many logical reasons as to why he evaded his income taxes, why he is against certain laws, why he voted for a particular candidate, why he considers his employer unfair, or why his employees are overpaid; but none of these may actually be a cause of his point of view or of his behavior. Sometimes he knows that the expressed reasons are false, but very often he is so intrigued by his reasons that he believes they must have been basic causes. The psychologist cannot take the risk of using such material upon which to base an analysis of behavior. For this reason he prefers to analyze situation and behavior data rather than rely on verbal reports from people when he wishes to understand the real reasons behind man's behavior.

SUMMARY

In summary we may say that the psychological approach to behavior is characterized by the fact that it accepts causation in behavior as a fact. It demands an analysis of the events that precede behavior. This in turn leads to an analysis of the situation and to the study of the individual and his past experiences. Whether the behavior is absenteeism, delinquency, hoodlumism, sit-down strikes, or race riots, it must be understood in terms of antecedent events if it is to be corrected. To criticize or condemn the behavior, to describe it as bad or inhuman, or to say that the new generation has no moral values or honor, not only fails to recognize causation, but suggests no remedy for the behavior.

HOW BEHAVIOR VARIES WITH THE NATURE OF THE STIMULUS

That people do quite different things in different situations is quite obvious. Sometimes, however, we may forget the obvious and blame the individual for the changed behavior. We know, for example, that honesty depends upon the situation (that is, a

complex stimulus) in which people find themselves, yet we sometimes classify people as honest or dishonest.[3] If the situation determines whether or not the behavior is honest, then people will differ only in the number of situations in which honest behavior appears. Consequently, most people will be honest in some situations and dishonest in others, and only a few extreme cases will be consistently honest or consistently dishonest.

It is true that the frequency of honest behavior can be increased with training, but it is likewise true that it can be increased by changing the situation. It is for this reason that punishment associated with theft, the locking of cars, business credit records, and the like reduce the amount of dishonest behavior. Even social pressure, such as that which honor examinations furnish, may serve as a stimulus for honesty. A student refrains from cheating because he has learned that his associates disapprove of such behavior. Another example may be drawn from the prohibition era. Prior to the depression of the thirties many people were making money easily and did not object when their neighbors made large profits by engaging in the liquor traffic to a greater or lesser degree. With a change in the economic situation, with the coming of the depression, however, people objected to the easy money made by liquor sales. As a result, sentiment for strict law enforcement replaced passive participation and attitudes of indifference.

The amount of labor trouble, turnover, and breakage varies with the situation. It is clear that the nature of man changes little from one era to another, but his behavior varies greatly with the times. When we say that people are getting worse, or that the younger generation is different from ours, we fail to take complete account of the part the stimulus-situation plays in behavior.

To take an example from industry, we find that, in many plants, there is resentment at punching the time-clock. Since

[3] H. Hartshorne, and M. A. May, *Studies in Deceit.*

fifteen minutes are deducted if a man is two minutes late, we find men waiting until the full fifteen minutes are up before they 'check in.' This condition actually makes some men later than they would be otherwise. It is also found that the men begin packing their tools ten or fifteen minutes before the end of the work period, or refuse to work a few minutes overtime to finish a job. Like the timekeeper, they also exaggerate the importance of a few minutes' time. This behavior may be called 'small' and be a source of irritation, yet it is directly related to the stimulus-situation. In plants where a responsible individual passes judgment on tardiness and arbitrary methods are not used such behavior symptoms occur less frequently.

The question of the efficiency of Negro workers has been raised frequently in connection with the war effort. In a war training class, consisting of graduate engineers engaged in supervisory work, it was generally agreed that Negroes were inferior craftsmen, lazy, dishonest, disagreeable, and unco-operative. It was also agreed that these were racial characteristics. To determine the validity of this general opinion, it was decided that each member should judge, from his own experience, whether Negro workers on the whole were inferior, equal, or superior to whites. Only three out of twenty-two rated them equal, twelve rated them as inferior, and seven had no basis for judgment. Further, it was determined in which shops the Negroes performed the same work as whites and in which shops the Negroes had more degrading positions. When this was done, it was found that the Negroes were rated inferior only in the shops in which they performed duties that the whites regarded as beneath themselves. In the three shops in which job discrimination was not present, the Negroes were found to be satisfactory. It was then reported that, in one plant where Negroes were extensively used on the night shift, this shift produced somewhat more than the morning and afternoon shifts. In all the plant's previous history the night shift had never produced as much as either of the other two shifts.

The modified general conclusion of the class was that the undesirable Negro behavior previously reported was caused by the situation rather than by the natural inferiority of the Negro race. This conclusion conforms with psychological findings, which report only questionable or small racial differences.[4] Even if it is granted that the average intelligence of Negroes is slightly below the average of the whites, it must be conceded that many Negroes are superior to a large number of whites. Individual variations in ability within a race far outweigh the difference between races. Since the market for white labor is carefully picked over during labor shortages, it follows that the Negroes available at such times are superior in ability to the whites who seek positions. This probably accounts for the fact that the night-shift production was equal or better than that of the day shift.

Any number of other illustrations could be given to show how the situation determines behavior. One need only recall how differently we, as children in school, behaved with different teachers. It is also common knowledge that one foreman can get much better work from a group of men than can another. These differences in behavior are obviously associated with differences in the situation.

HOW THE NATURE OF MAN DETERMINES BEHAVIOR

A man's nature depends upon the way he grew and the way he was modified by experience. How he grew depends upon the quality of the chemical substance in the fertilized egg which his parents were able to produce, as well as upon the environmental conditions under which this egg developed into a living person. Because the growth of an egg does not proceed unless the growing conditions are favorable, the early environmental factor is very similar for the majority of people. Such differences in growth that do appear, therefore, are largely influenced by the chemical

[4] H. S. Jennings, C. A. Berger, D. T. V. Moore, A. Hrdlička, R. H. Lowie, and O. Klineberg, *Scientific Aspects of the Race Problem*, pp. 253–291.

constitution of the egg. We speak of this influence as 'heredity.' These differences, in turn, may be transmitted to the next generation. It is clear that heredity is an extremely important factor in determining the nature of man. Its importance can be seen when we compare the physical likenesses of parents and offspring. The potential abilities of offspring also tend to show similarities with those of their parents. If one member of a family is a good workman on a given kind of job, there is some probability that his brothers will be equally satisfactory both in temperament and in potential ability. This relationship is perhaps as good a recommendation as any that can be given without resorting to psychological tests. To a lesser degree, cousins show similar abilities. It is because of this hereditary factor that we may expect musicians, football players, expert machinists, and the like to appear in certain families.

As a child grows, he gradually develops his ability to learn; as a consequence, his behavior is subject to further modification. We speak of such changes in behavior as 'acquired.' Knowledge, skill, and language are obviously acquired and represent important modifications in behavior. The value of practice in acquiring skill is too apparent to require discussion. The learned modifications in behavior are not passed on to our children, but must be acquired by them through their own personal experience. Such aspects of behavior are culturally determined. Differences between races are primarily due to cultural factors.

Because man's nature is both inborn and acquired, we must always distinguish between these two types of influence. We cannot expect skill from an untrained individual, nor can we expect two individuals with the same training to be alike in their ability to produce. Blaming a man for not doing a job which requires a skill that he has no inborn capacity to acquire is as pointless as blaming one chemical substance for not being another. It is as unjust as blaming a man for not having a skill before he has been trained in that skill.

DIFFERENCES BETWEEN EMPLOYER AND EMPLOYEE THAT MUST BE EXPECTED

If actions and thoughts depend upon the organism and the situation, it is obvious that labor and management will not agree with each other on a good many questions.

From the economic aspect alone, they are in different situations and have different backgrounds of experience. Labor is interested in high wages, while management is interested in good profits. These goals necessarily conflict. The solution of the problem involved in the conflict hinges on the question of what constitutes a fair division of the return from goods produced. Any satisfactory adjustment requires an appreciation of the fact that this conflict is real and fundamental. In order to preserve an economic system which permits the development of such opposed interests, it is necessary that both parties recognize the basis of the difference. To condemn one for not agreeing with the other is to demand that people with different past experiences and occupying different situations show the same behavior. This amounts to demanding something which does not occur in human nature.

Other basic differences between employer and employee may be caused by differences in social and economic security, the pleasantness or unpleasantness of the work they perform, the kind of opportunities they have for travel and relaxation, their educational backgrounds, and their opportunities for satisfying the ego. A general difference in intelligence will affect the ambitions, interests, and aptitudes and make one group more dependent upon leadership than the other. These and many other factors will inevitably lead to conflict between labor and management or between employer and employee, unless proper steps are taken to reconcile them in terms of conditions which produce them. As a matter of fact, differences between groups of people (or even between individuals) are sometimes assets, which, if

properly utilized, may effect a better division of effort or a more satisfying social order. It is always the psychologist's aim to determine what are the characteristics of a man and, whenever possible, to utilize what he has rather than to attempt to interfere with or inhibit his impulses or interests.

As soon as groups with opposed interests recognize that both points of view must be acknowledged and understood, they can approach the differences as problems to be solved rather than as signs of perversity and wickedness in their opponents. Labor and management can accomplish much at a conference table when mutual respect for each other's point of view is attained. Failure to respect different points of view is actually a refusal to recognize the fact that experience and heredity determine the way men see things and the manner in which they react to them.

One example of how the same thing can be viewed in quite different ways is illustrated by Figure 1. This figure may be seen as a pair of *X*'s, or as an upright and an inverted *V* superimposed on each other. To argue as to which is right is quite futile. Both are interpretations of the nature of the figure. If one

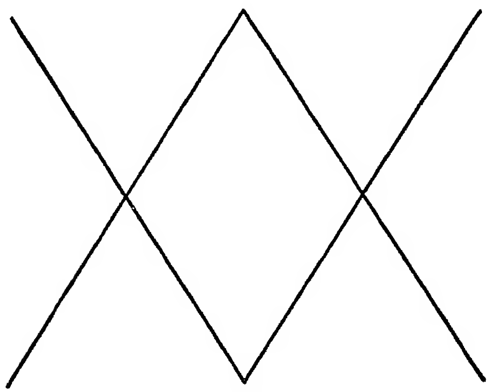

Figure 1. Variation in the Perception of Objects

The above figure may be seen as two X's or as an upright V superimposed on an inverted V. If it is suggested that a W may be seen on top of an M, these will appear. The mention of a diamond will again change the perception of the object. What really is pictured depends upon a person's point of view. Facts, as well as objects, vary with the way in which people see them.

person expected to see the X's, he would be more likely to see them than another who expected to see the V's. Suppose seeing an X makes you angry. If I innocently place the figure before you, am I responsible for your anger or is your interpretation responsible? Trying to place the blame is obviously pointless. There are even more ways of seeing this figure. To aid you in finding them it is necessary only to give you some added experience. I merely suggest that the figure represents a W on top of an M, and now you too can see these letters. You will even see a diamond with whiskers on its sides as soon as it is suggested. On a subject like this, most people can be open-minded and see other people's points of view when they are pointed out to them.

In many real-life situations, however, it is often difficult for us to see the other person's point of view. For instance, let us consider the problem of labor organization. From one person's point of view, unions should exist; from another's, they should not. It is a fact, however, that they do exist; since they do, many men have the experience of being organized. Even if all unions were abolished, these men would still have had this experience, and, because it has modified or changed them, they could never return to the state of the unorganized workers of former years. Once we recognize that this is true, then we shall face the labor situation from a new point of view. No longer shall we debate as to whether or not unions should exist. Rather, we shall accept organized labor as a fact. Then our problem becomes one of determining how to utilize it so that it will be an asset rather than a liability to scientific management.

Actually, there are many issues on which labor and management can agree, despite their differences in experience. Increased production, for example, can benefit both. In plants where understanding and good relations exist, labor, as well as management, has frequently contributed to the establishment of improved methods of production. Points of agreement cannot be found,

however, as long as each must gain its ends at the expense of the other. For instance, if labor must struggle for the survival of its unions, it is unlikely that it will favor the survival of a private enterprise which jeopardizes their existence.

We have seen that, because of different backgrounds and experience, labor and management are likely to differ in economic and social outlooks, as well as in their general points of view. Because of these differences, problems necessarily arise. The solution to these problems lies in accepting the differences and in dealing with them on a basis of mutual understanding and respect, or, when desirable, in modifying them by modifying the situations which cause them. The importance of finding the solution may be emphasized by an understanding of social responsibility.

Both management and labor have certain social responsibilities which they must meet if the system of private enterprise is to operate unhampered by governmental restrictions, or even to survive at all. Since it is more to the interest of the owning classes than to that of the masses of labor to preserve this system, the former, especially, should have an understanding of their responsibilities and take a long-range point of view.

A basic requirement of social progress is that human needs be satisfied. To meet this requirement, industry must develop conditions which permit good health, opportunities for happiness, and security against unemployment.

Security against unemployment is one of the major responsibilities of industry. Unemployment is a great economic loss to society, but this loss is dwarfed when compared with the damage it does to human beings. Even if we discount the obvious damage to the health of a nation, we must still recognize the distorted personalities it produces. Psychological studies have shown that the unemployed man becomes emotionally unstable, loses his sense of values, develops feelings of inferiority and loses self-confidence, shows poor morale, and acquires habits of loafing and

killing time.[5] In general, his spirit is broken and he tends to become an unemployable man. It is an inefficient society which fails not only to use manpower for productive purposes, but actually creates a situation which destroys the effects of years of training in skills and years of experience in which emotional adjustments and democratic values have been built up.

A history of insecurity in work is the background for many of the differences between management and labor. It has caused labor unions to demand seniority rights and to oppose methods designed to increase efficiency in production. Since this opposition frequently hinders progress, it is sometimes argued that organized labor opposes progress. This opposition, however, should be expected rather than resented. It is the task of management to understand the point of view of labor and to introduce improved methods in such a way that the security of the workingman will not be impaired. By means of proper understanding between labor and management, labor can have the experience of benefiting from increased production and will thereafter tend to favor improvements, and may even suggest them. Many industries are learning that such co-operation makes it possible, not only to survive in competitive markets, but even to grow. To make concessions too slowly, however, will draw the lines of difference more sharply and exclude a compromise.

[5] A summary of many studies is given in a review of the literature by P. Eisenberg and P. F. Lazarsfeld, "The Psychological Effects of Unemployment," *Psychol. Bull.*, 1938, *35*, 358–390.

3 THE PSYCHOLOGY OF ATTITUDES

INTRODUCTION

In the preceding chapter, it was pointed out that the behavior of an individual depends upon the manner in which he experiences the stimulus. Thus, the reactions of the owner of a factory may be quite different from those of a workman whom he employs, because each would experience the factory situation in a different way; that is, the factory situation may be a different stimulus for the owner and for the workman. As a matter of fact, we cannot even suppose that all employees will agree on the nature of such a complex stimulus. Although it is quite impossible to take into account all the individual variations, it is of interest to determine whether or not there are common trends and basic principles, so that some guide to an understanding of people in general may be obtained. Psychologists are aware that the attitude of the individual is an important factor in determining the way in which he will experience a stimulus-situation. Thus, a knowledge of attitudes greatly simplifies the understanding of the reactions of people.

For example, employees may show resentment when they see two supervisors talking to each other. The reason for this resentment becomes clear when we recognize that there is an attitude of suspicion among the employees which permits them to believe that they are being discussed and criticized. Likewise, a bell signal which indicates the time for rest pauses may be dis-

liked by many because it is experienced by them as a symbol of regimentation rather than as a signal for relaxation. Many aspects of a work situation have quite different meanings for the employees from those intended by management, but it is the employees' interpretation of the stimulus, not the manager's intention, which clarifies the behavior of the employees. Whether the worker sees the supervisor as a helper or as a disciplinarian is important in determining whether the supervisor's actions are interpreted with an attitude of suspicion or of generosity.

Before dealing with the general question of attitude, it is desirable to know to what extent the employee's attitude toward the factory, the owner, the foreman, or the other employees influences his behavior on the job. The manager who is interested in obtaining a good day's work from each employee may feel that what the latter thinks about him or the factory is quite irrelevant. Even if a few socially minded employers or plant managers are concerned with the pleasantness of the employees' reactions, this interest is too elusive to influence employers in general. If the subject of attitude is to be a major concern of industry, it must be shown to have a direct bearing on efficiency. That it may also have a bearing on other problems we shall see when we consider its effect on labor relations, labor-union activities, social legislation, and the quality of the employees who apply for jobs. Since some studies on the rôle of employee attitudes in work proficiency have already been made, we shall briefly consider one of the most complete of these investigations before proceeding to a psychological analysis of attitudes.

A PRACTICAL DEMONSTRATION OF THE EFFECT OF ATTITUDES ON PRODUCTION

The intensive research program carried on by the Western Electric Company, Hawthorne Works, Chicago, clearly demonstrates the effect of employee attitude on production.[1] The ex-

[1] F. J. Roethlisberger, and W. J. Dickson, *Management and the Worker*.

periments were begun as an attempt to investigate the effects on production of such factors as temperature, humidity, lighting, rest pauses, and length of work-day. For this purpose an experimental room was designed in which a standard operation could be performed under varying conditions without disrupting the work of the remainder of the plant. The results of the preliminary studies revealed that the factors under investigation could not explain many of the results obtained. Although the introduction of rest periods of varying lengths, rest periods with lunches, and different lengths of work periods showed trends in production which indicated their beneficial effects, a general upward trend in production also was apparent. The general trend became very clear when it was found that the removal of the above-mentioned favorable conditions did not return production to its previous level.

Analysis of the data revealed that a more favorable work attitude had gradually developed. Since the experimental room was in the charge of an observer rather than a supervisor, the employees felt more free. Things were talked over freely with them and they developed confidence in the company. As a consequence, conversation between employees became more frequent, their social relations more friendly, social activities were carried on outside the work situation, absenteeism declined sharply (in one case to nearly one-fourth of that shown outside the experimental room), and production rose.

Increased co-operation between employees was apparent from the fact that workers helped each other out, so that, when one had an off-day, another made up for it. Employees set their own pace and felt free to slow down or speed up as they wished. Although part of the co-operative effort was due to the fact that pay was based upon the production of the group, this factor did not account for all of the changes.

In another experiment a fall in production was associated with a rumor that a job was to be moved from the Chicago plant to

New Jersey. The feeling of insecurity caused by this rumor immediately had an effect on attitudes and production was affected, even though there was no conscious intent to limit production and employees reduced their pay by doing so.

The importance of attitude on work revealed in the early experiments caused the investigation to take an entirely different turn. Emphasis was placed on improving supervision in order to obtain more favorable work attitudes, and an extensive program of employee interviewing was begun. Interviewers were trained to listen and to encourage free expression. They were careful not to take a stand on any issue and avoided any attempt to change an employee's point of view.

The interview material clearly showed that opinions about the company were influenced by home conditions (for example, indebtedness encouraged the opinion that pay was inadequate); by the employee's social position in the group in which he worked (what privileges and opportunities he had in comparison with those of others), as well as by the visible working conditions. The investigators began to realize that the factory was a social as well as a work environment and that these background conditions could not be ignored in the study of employee satisfactions and productivity.

The actual interviewing program had some immediately beneficial effects, in addition to furnishing insight and material for future investigation. Three of the important benefits are given below.

1. It allowed for the correction of unfavorable work conditions. Although the actual working conditions are known to management, it does not know how employees feel about these conditions. This feeling is an important factor in efficiency.

2. It caused supervisors to realize that their methods were being studied, thus stimulating them to greater effort

and interest in their work. The results of the study also aided in the selection and training of interviewers and furnished valuable case material to be used as a basis for the training of supervisors.

3. The employees benefited by the "lift" they got. There was no question about the desirable effect of expressing their feelings and emotions freely. It made them see improvements in working conditions where none had been made; it also made them see their boss as a changed person.

To gain a further understanding of some of the social factors, a final experiment was conducted. In this case, the experimental group of workers was again segregated in the experimental room, but the departmental foreman was kept in charge. This time the segregated group did not improve its proficiency. Although it developed a social structure, its informal organization resisted change. Incentive group pay in this case elicited quite different attitudes from those found in the previous experimental group. Such values as the following became apparent:

1. You should not turn out too much work or you will be a "rate-buster."
2. You should not turn out too little work or you will be a "chiseler."
3. You mustn't tell a supervisor anything which will react against an associate or you will be a "squealer."
4. You must not act officious or you are "for the company." According to this "code," an inspector must not act like an inspector. If he does, there are many ways in which the worker can interfere with him. In this way antagonisms accumulate and the situation grows worse.

Another interesting development was the appearance of informal organizations and social hierarchies within the experimental room. Each kind of work acquired a social level or status.

Sometimes the mere location of the work (front or back of room) became a distinguishing feature, even if the work was the same. Other factors influencing the social status of the job were type of work, wages, vacations with or without pay, the kind of desk or work space, and any other feature which tended to go with one kind of work and not with another. Social meanings became attached to these distinguishing features, these meanings being derived from attitudes toward social status. The same words spoken by persons having different status had altogether different meanings. Thus, a foreman's mild criticism might be called a "bawling-out," whereas a supervisor's violent criticism might be passed off almost unnoticed.

The workers also formed themselves into subgroups, and the social relationships of each individual in the room were almost entirely limited to the subgroup of which he was a part. As all members of a social group tend to have a common interest, the distinguishing object in this case seemed to be the inspector. Men having the same inspector tended to become a closed group. Since the grouping was not on the basis of social status, men of different social status appeared in each of the groups. Although these groups developed different interests and different loyalties, the men occupied social positions within the group according to their status. Those low in status accepted the rôle of errand boy.

Observations of this sort demonstrated the intricate informal structure which appears in any group of workmen. Whether this informal organization resists change or co-operates depends upon its nature, which, in turn, depends upon the way the situation is handled. When things are done by management in such a way that they conform to the wishes of the persons involved, and when situations are made freer, carry responsibilities and privileges, and increase social status, co-operative behavior is most likely to appear. In a strict atmosphere, workers have many ways in which they can curtail productivity; the most common method being the limitation of each individual's production to a specified number of units per day.

Recognizing the importance of these complex attitudes and the social factors in the work situation, the plant has embarked on a counseling program. The counselor has no jurisdiction over workers. He can hear complaints, draw people out, help them understand themselves, and help supervisors to understand many problem cases by drawing attention to certain factors in their lives or in the work situation. If these things are done by individuals outside the department, and confidences are not betrayed, the company can obtain a realistic picture of the state of morale in the plant, as well as reduce the formation of attitudes so disruptive to co-operation and understanding.

The Hawthorne study clearly shows that the attitudes of workmen are basic factors in industrial relations because they influence both individual performance and group effort. Since attitudes are not founded on logic, the layman is often inclined to be unsympathetic with them and pass them off as silly or unworthy of consideration. It is hoped that a psychological analysis of attitudes will place this subject in its proper perspective and increase the understanding of human relations. For this reason the remainder of this chapter and the two chapters following are specifically devoted to problems associated with attitude. Strictly speaking, we shall never leave this subject entirely, since it enters into all phases of industrial problems.

A CLOSER EXAMINATION OF THE NATURE OF ATTITUDES

ATTITUDES AS A FRAME OF REFERENCE

Psychologically, an attitude is a kind of mental set. It represents a predisposition toward opinions. Suppose an employee is asked what he thinks about his rate of pay. What he gives for an answer is his opinion. The attitude is more general and influences his opinion. An unfavorable attitude toward the company would cause a worker to express a series of unfavorable opinions. His opinions on matters not covered by direct questions could be predicted, once a knowledge of his attitude had been

gained. If something happened to change the attitude, his opinions on certain topics would show a marked change.

In a sense, an attitude is a frame of reference. How a frame of reference influences our specific views of things can readily be illustrated by the diagrams in Figure 2. From these diagrams it

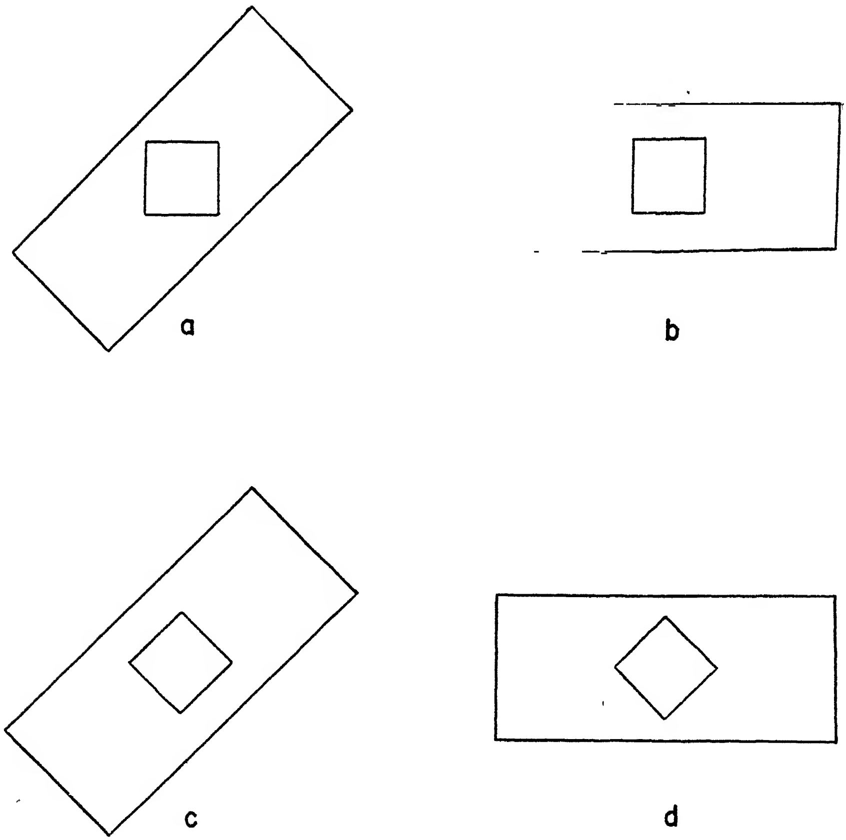

Figure 2. The Influence of a Frame of Reference

The inner geometrical figures in a and b are the same, yet they are seen as a diamond and a square, respectively, because they are framed differently. The same two frames applied to the small figures in c and d make them appear as a square and diamond, respectively. Just as the frame gives specific meaning to the inner figure, so an attitude determines an opinion. A change in attitude may radically change opinions. (After Koffka, K., "Principles of Gestalt Psychology," New York: Harcourt, Brace and Co., 1935, p. 185.)

can be seen that the interpretation of the inner figure depends upon the outer frame. In *a* and *b*, the inner figures are the same, yet one appears as a diamond and the other as a square. In *c* and *d*, the situation is reversed. The same diamond figure can be either a square or a diamond, depending on how it is framed. If we think of the inner figure as a given objective fact (the rate of pay, for example), the diamond as a favorable opinion (pay is as good as can be expected), and the square as an unfavorable opinion (company is exploiting the workers), then it follows that our opinion of the objective fact depends upon the frame of reference. This outer frame corresponds to one's attitude.

ATTITUDES DETERMINE OPINIONS AND PREJUDICES

Conservatism and radicalism are two extreme kinds of attitudes. People with these differing attitudes have divergent opinions about the same facts. An observer can predict quite accurately what a man's opinion on labor legislation will be if he knows the man's attitude. Likewise, from a survey of a pattern of opinions, it is possible to construct the general attitude which is shaping opinion.

Disagreements over the nature of a given set of facts are possible because attitude influences the way the facts are experienced. Our various prejudices offer many illustrations of attitudes that determine the meanings which facts may assume. The actual facts which conflict with the prejudice are rationalized to fit with the general attitude, this rationalization serving to protect the attitude from change. The following excerpt describes how people with racial prejudices react to factual information about Mr. Miller, who is a Jew:

> If Mr. Miller succeeds in business, that "proves" that "Jews" are "smart"; if Mr. Johansen succeeds in business, it only proves that Mr. Johansen is smart. If Mr. Miller fails in business, it is alleged that he nevertheless has "money salted away somewhere." If Mr. Miller is strange or foreign in his habits, that "proves" that

> "Jews don't assimilate." If he is thoroughly American — that is, indistinguishable from other natives — he is "trying to pass himself off as one of us." If Mr. Miller fails to give to charity, that is because "Jews are tight"; if he gives generously, he is "trying to buy his way into society." If Mr. Miller lives in the Jewish section of town, that is because "Jews are so clannish"; if he moves to a locality where there are no other Jews, that is because "they try to horn in everywhere." In short, Mr. Miller is automatically condemned, no matter who he is or what he does.[2]

ATTITUDES RECONCILE CONTRADICTIONS

Many people hold what appear to be conflicting opinions. Such apparent contradictions in thinking are not always due to lack of intelligence, as is frequently supposed. Rather, they are made possible by the development of certain attitudes. With the proper attitude as a background, intelligent people can reconcile what to others are obvious contradictions. It is frequently surprising to us to see the kind of propaganda the German Government released to its people. For example, their radio commentators voiced indignation when bombs killed their children and spoke of the brutality of the enemy. However, when German bombs killed women and children, it was because of necessity; and this necessity grew out of the enemy's desire for war. They described the Russians as being unfair in waging war. Russian soldiers played dead, and then, when the German tanks were about to ride over them, they came to life and destroyed the tanks. Through much of the German propaganda there was a criticism of peoples who defended themselves. The same behavior may, therefore, be unfair or clever, good or bad, necessary or barbaric, depending on who performs it.

To make such contradictions make sense requires a certain attitude. For the Germans it was an attitude of superiority — they were the master race. The German attitude toward other races was similar to the one which most of us have toward ani-

[2] S. I. Hayakawa, *Language in Action*, pp. 142–143.

mals. A fisherman feels superior to a fish. He may make fun of the fish if it resists being pulled into the boat. If in its struggles the fish strikes back, however, the fisherman becomes indignant. A fish can't do that to him!

The Germans embarked on a long propaganda program to build up this attitude of superiority so that what was "sauce for the goose" would not be "sauce for the gander." Because childhood attitudes tend to persist throughout life, the Germans wisely instituted their youth movements, the importance of which has now been recognized by all political observers.

Scientists were called upon to aid in building up the superiority attitude. A quotation from an anthropologist will serve as an illustration:

> In non-Nordics the teeth, corresponding to the snout-like narrowness of the upper jaw, stand at a more oblique angle than in animals. . . . The grinding motion of chewing in Nordics allows that chewing to take place with the mouth closed, whereas the squeezing nature of chewing in men of other races inclines them to make the same smacking noises as animals.
>
> But the Nordic mouth has further superiorities. Just as the color red has a stirring effect, the bright red mouth of Nordics attracts, and provokes kisses and courtship. It looks prepossessing and, as it were, kiss-capable.
>
> On the other hand, the non-Nordic's broad, thick-lipped mouth, together with his wide-dilated nostrils, display sensual eagerness, a malicious and false leer, and a sipping movement indicative of voluptuous self-indulgence.
>
> Talking with the aid of hands and feet is characteristic of non-Nordics, while the Nordic man stands calmly, often enough with his hands in his pockets
>
> We find a pronounced sense of modesty in the Nordic civilization only, which actually has the one word "Scham" to mean both modesty and privy parts. But the dark-skinned man is hardly able to blush externally.
>
> There is present in Nordic men an instinct for purity both without and within . . . the non-Nordic is forever living in dirt, to which his presence but adds.

> The non-Nordic man occupies an intermediate position between the Nordics and the animals, just about next to the anthropoid ape. He is therefore not a complete man. He is really no man at all in true contradistinction to animals, but a transition, an intermediate stage. Better and more apt, however, is the designation "Sub-human."[3]

This attitude of superiority of some men over others was not confined to Germany, but appears in democracies as well. Because of its presence in many of us, we tend to be insensitive to the suffering, even within our own country. We speak of the masses as if they were a race apart from us. We hear that Negroes in the South do not appreciate good food, since they obviously are content to live on cornmeal mush; otherwise, why would they eat it day after day? It is argued that Negroes prefer to live in an unsanitary way, as demonstrated by the fact that they do it. Some business executives refuse to sit at a conference with labor leaders because it would be beneath them.

An attitude of superiority makes it possible to hold conflicting opinions about the same set of objective facts. When the facts concern the superior group, they mean one thing; when they concern the inferior group, they mean something else. This implies that the psychology of one group is different from that of the other. No evidence for two psychologies of behavior has been found, however, and there seems little prospect for finding any.

Different levels of social status are present in all companies, and certain privileges go with rank. Thus, a man on salary may get vacations with pay and the opportunity to choose his own time for rest pauses, but he believes that the rank-and-file workman should not have these privileges. The rank-and-file workman, on the other hand, may criticize his supervisor for coming to work late, resent the strict supervision to which he is exposed, and insist that he is entitled to vacations with pay. These conflicting points of view are real and human and are the outgrowth

[3] From H. Gauch, *New Bases of Racial Research* (Berlin, 1933), as translated by J. F. Brown, *Psychology and the Social Order*, pp. 124–125.

of the social structure. When we recognize that many of our beliefs are based on attitude, we are likely to react more reasonably because we do not suffer from righteous indignation. I can be tolerant of the workman's point of view if I know that he and I are both prejudiced. If each of us insists he is right, we merely become more prejudiced.

When a foreman characterizes a work stoppage as loafing, while the workingman considers it resting, the difference in meaning is one based on difference in position. When a supervisor observes a workman on the job, the interpretations of spying and of evaluating work methods are possible — it is unnecessary to point out which individual takes which interpretation. When a supervisor thinks a certain individual is the logical one to be transferred, will the individual in question follow his logic? These are important everyday problems in industry, and one cannot logically prove to the other that his interpretation is the right one. Rather, one must alter the cause of the difference (that is, the attitude) if a meeting of minds is to occur.

Similar to attitudes which give rise to opinions of superiority are the attitudes which differentiate opinions concerning in- and out-groups. Persons who belong to our own social groups (our union, our church, or even our race) are judged differently from those outside our group. In this case, the differential attitude toward the out-group is not so unfavorable as it would be toward an inferior group; nevertheless, sympathy and tolerance tend to be denied to the outsider. It takes less evidence to prove that a person outside our group is incapable of performing his duties or unworthy of our help and protection than it does to prove the same things about members of our own group. Our loyalties and our prejudices are frequently in-group and out-group attitudes, respectively, and, although they are prevalent and normal, they must be listed as sources of error in arriving at objectively sound conclusions.[4]

[4] A good discussion of this subject is found in Brown, *op. cit.*, pp. 116–119.

RELATIONS BETWEEN ATTITUDES, EMOTIONS, AND REASON

Attitudes usually are associated with likes and dislikes, and consequently have an emotional content. Any condition which influences emotion, therefore, is likely to influence certain attitudes. Our moods are temporary predispositions toward having certain emotional reactions. As a consequence, it is to be expected that our moods will influence our attitudes. In one mood, a foreman will fly into a rage at a workman's mistake, while, in a different mood, he may pass it off as something that could happen to anyone. If the foreman has heard unfavorable opinions about a racial group, and if the workman belongs to this group, the foreman's emotional experience will aid in his acquisition of an unfavorable racial attitude.

The effectiveness of propaganda in influencing public attitudes may depend upon the moods of the people, since these moods play an important part in determining the favorable and unfavorable reception of attitudes. Prevalent attitudes in society may be quite ineffective in guiding the attitudes of many individuals until emotions are aroused. Once emotions are stimulated, however, the prevalent attitudes become important factors in determining whether or not a specific emotional reaction will be applied to an individual or to a group of individuals. Unfavorable reactions to groups are most common during periods of tension, partly because moods tend to be unfriendly at such times and relatively dormant attitudes are revived. Other factors which make trying times favorable for the development of prejudice will be discussed in the next chapter.

Because opinions and emotional reactions frequently are closely associated, mood and attitude are often difficult to differentiate. In general, a mood may be regarded as temporary and dependent upon one's physiological condition. Poor health, loss of sleep, hunger, and emotional upsets are conditions which influence man's physiological condition and produce moods which predispose him to make unpleasant reactions.

The psychology of attitudes has been the subject of considerable interest in the past decade. We often think that our opinions are based on our thinking or reasoning. The study of attitudes, however, requires an alteration of this belief. Man is not the rational being he would like to think himself. Rather, he holds opinions which are largely influenced by attitude and then uses his reason to defend his opinions. Such rationalization is a common form of mental activity. We all know that a man may fail to change his opinion, even though we refute every one of the points he has used to support his position. The next time we see him, he has another set of reasons. Our efforts have changed only his reasons, not his opinions.

This does not mean that reason never influences opinion. Rather, it is our purpose to point out that attitude is the more important factor, and that it influences, not a large number of people in all their opinions, but all the people in a great many of their opinions. On some subjects practically all people are reasonable, and on others practically all have an emotional bias.

The importance of emotion in determining opinion has been experimentally demonstrated in a study which showed that people have a striking tendency to believe in statements which corresponded with their desires rather than in those which were logically sound.[5] For example, the more we wish a raise in pay, the more we are inclined to believe a slogan which states we are underpaid and overworked. When wishes and desires enter into the picture, logic suffers. The lack of logic in attitude is also apparent from the fact that opinions on related subjects frequently are contradictory.[6] On one day an employee might argue for incentive pay, and on the next day he might criticize a promotion because it violated seniority privileges.

[5] F. H. Lund, "The Psychology of Belief," *J. Abnorm. Psychol.*, 1925, *20*, 63–81; 174–196.

[6] R. Stagner, *Psychology of Personality*, p 175.

PERSONALITY DIFFERENCES AND ATTITUDES

Personality differences are highly important in determining the type of attitude formed. Some individuals are inclined toward radicalism, others toward conservativism, and still others avoid extremes. These tendencies seem to be so general that they are sometimes regarded as personality differences.[7] Likewise, differences in social dependability, decisiveness, and emotionality may influence attitudes on specific topics. Other factors, such as sex and intelligence, have also been shown to have rather specific effects on opinion. Differences in personality makeup and intelligence must account for the individual variations which occur when experiences are comparable. To what extent the personality differences are inborn and to what extent they are acquired is not known, but undoubtedly some of the differences must be attributed to heredity.

The factor of experience in attitude formation is our primary concern in the present discussion, since this factor is most readily altered. The extent to which attitudes are influenced by experience largely determines the degree to which they can be controlled, as well as accounts for group trends among individuals having similar backgrounds.

THE MEASUREMENT OF ATTITUDES

In order scientifically to analyze the factors which influence attitudes, it is necessary to obtain some objective measurement of them. Some discussion of techniques is desirable because their elucidation will further clarify the nature of attitudes, as well as exemplify methods which have been used in industry.

METHODS OF MEASURING ATTITUDES

The most simple method is merely to count the number of people who are for or against something. This method does not measure the degree of feeling in any individual, but registers only

[7] Stagner, *op. cit.*, pp. 176–186.

the direction of the attitude. When groups of people are studied, however, the number of people having a given attitude is some index of its strength. This is essentially what the Gallup poll accomplishes in its 'America Speaks' analysis. It is possible, however, that, on the one hand, a large number of people will be mildly opposed to something, but would not be greatly disturbed if they had to accept it; while, on the other hand, a smaller group might be strongly opposed to something and its adoption might cause a violent minority reaction. In such cases the number of people holding an opinion would not accurately indicate its actual social significance. To make possible a study of the strength of attitudes in the individual, it is necessary to have more refined instruments of measurement. We have one such instrument in the *attitude scale*, which was devised by Thurstone.[8] In making up such a scale, a large number of statements bearing on the topic on which attitude is to be measured are collected. The topic may be religion, politics, a particular race or country, birth control, or labor unions. These statements are then experimentally analyzed to see that they are not ambiguous and that they are diagnostic in representing a position for or against the issue involved. Only the diagnostic items are retained, each of which is assigned a scale value between 0 and 12. Those statements which strongly favor the issue receive a high (or low) value, those strongly opposed receive a low (or high) value, and those in between are given intermediate values. All these scale values are based upon previous experimentation and are arrived at objectively. The actual scale may consist of forty or even fewer statements. An example of such a scale is shown on page 82.

To measure the attitudes of a group of people, one merely has each person place a plus sign in front of all items which express his sentiments, and a negative sign in front of all others. A person's score is the average of the scale value of all items checked with a plus sign. If one person's score is 5, he has a more favorable

[8] L. L. Thurstone, and E. J. Chave, *The Measurement of Attitude*.

attitude on the subject tested than a person who has a score of 3. Low and high scores indicate the two extremes in attitude.

A more simplified method is to ask people to put a check mark on a five-point scale placed below a number of statements concerning a certain topic. One end of the scale is labeled "strongly against," the other "strongly for," and the middle is labeled "neutral." An illustration of this type of attitude scale is shown in Table 1. This particular scale was designed to measure atti-

TABLE 1. ATTITUDE TOWARD NEGROES

All Negroes belong in one class and should be treated in about the same way.

Strongly Approve	Approve	Undecided	Disapprove	Strongly Disapprove
(1)	(2)	(3)	(4)	(5)

Negro homes should be segregated from those of white people.

Strongly Approve	Approve	Undecided	Disapprove	Strongly Disapprove
(1)	(2)	(3)	(4)	(5)

When there is segregation, the Negro section should have the same equipment in paving, water, and electric light facilities as are found in the white districts.

Strongly Approve	Approve	Undecided	Disapprove	Strongly Disapprove
(5)	(4)	(3)	(2)	(1)

If the same preparation is required, the Negro teacher should receive the same salary as the white.

Strongly Approve	Approve	Undecided	Disapprove	Strongly Disapprove
(5)	(4)	(3)	(2)	(1)

Practically all American hotels should refuse to admit Negroes.

Strongly Approve	Approve	Undecided	Disapprove	Strongly Disapprove
(1)	(2)	(3)	(4)	(5)

No Negro should be deprived of the franchise except for reasons which would also disfranchise a white man.

Strongly Approve	Approve	Undecided	Disapprove	Strongly Disapprove
(5)	(4)	(3)	(2)	(1)

In a community of 1000 whites and 50 Negroes, a drunken Negro shoots and kills an officer who is trying to arrest him. THE WHITE POPULATION IMMEDIATELY DRIVE ALL THE NEGROES OUT OF TOWN.

Strongly Approve	Approve	Undecided	Disapprove	Strongly Disapprove
(1)	(2)	(3)	(4)	(5)

tudes toward Negroes. Note that each statement involves only one judgment and that ambiguity in expression has been carefully avoided.[9] In this type of scale, the person rates or judges the intensity or strength of his own attitudes. By having a number of statements on the same subject and giving a value for each intensity, varying scores are obtained. The total score, then, represents strength of attitude. The virtue of this rating method is its simplicity.

Although the above scale was included to illustrate a method, the topic is also pertinent to industry. The employment of Negroes undoubtedly will be an issue which must be faced realistically, and management often fears the reactions of its white employees. Attitude measurements will give an indication of the trend in attitudes toward Negroes, thus furnishing a basis to determine the rate at which they can be absorbed.

Industry cannot afford to make radical changes which will backfire. Since attitude scales can furnish sufficiently delicate indices of changes in attitude, their use will indicate unfavorable trends, and thus make it possible to prevent open violence or mass work stoppages.

SOME EXPERIMENTAL FINDINGS

By means of attitude measurement, it has been found that a single situation, such as a movie, can greatly alter attitudes on racial,[10] social, and economic questions.[11] Other findings have shown that (1) unemployment disturbs former religious and economic values;[11] (2) radical students are more inclined to be highly intelligent than non-radical ones, despite the fact that children of professional classes tend to be conservative;[12] (3) a speech

[9] R. Likert, "A Technique for the Measurement of Attitudes," *Arch. Psychol.*, 1932, no. 140, p. 55.

[10] L. L. Thurstone, "The Measurement of Social Attitudes," *J. Abnorm. & Soc. Psychol.*, 1931, *26*, 249–264.

[11] S. P. Rosenthal, "Changes in Socio-Economic Attitudes under Radical Motion Picture Propaganda," *Arch. Psychol.*, 1934, no. 166, p. 46.

[12] O. M. Hall, "Attitudes and Unemployment," *Arch. Psychol.*, 1934, no. 165, p. 65.

given in person is more effective in influencing attitudes than the same speech given by radio, although the latter is more effective than reading the same speech;[13] (4) shifts in attitude, when they occur, often go from negative to positive agreement without taking an intermediate stand in the neutral position;[12] (5) radical attitudes are more difficult to modify than are conservative attitudes.

One of the most thorough analyses of attitude changes was made in the Bennington College community.[14] In this community, prestige was closely associated with liberal attitudes on political and economic subjects. This prestige factor caused a constant shift in attitude, from conservatism to liberalism, to take place throughout the four years in college. Although the students came from relatively conservative environments, this changed attitude tended to persist after leaving college. Most significant, however, is the finding that attitude change was closely related to certain personality traits.

Students who tended to become liberal were quite independent of their families and, instead, were self-dependent or dependent upon their own age group. Those who were self-dependent were very intelligent, on the whole, and developed their liberalism through intellectual pursuits. Some of them had a history of good emotional adjustment, while others had personality problems, but these factors merely influenced their college life. Personal stability did not influence the attitude development of these individuals because their attitude was based on intellectual factors.

The liberal students who were dependent upon the group tended either to follow the group or to have desires to become leaders. Their liberalism was definitely due to a personality tendency to conform with the group, and in another college atmosphere they

[13] W. H. Wilke, "An Experimental Comparison of the Speech, the Radio, and the Printed Page as Propaganda Devices," *Arch. Psychol.*, 1934, no. 169, p. 32.

[14] T. M. Newcomb, *Personality and Social Change; Attitude Formation in a Student Community.*

might have had quite different attitudes. This group was clearly subject to the social influence of attitude formation.

The individuals who tended not to change attitudes in accordance with the college trend were strikingly dependent on family ties. These individuals tended either to have a history of insecurity and frustration or to be well adjusted, but uninterested in social prestige and social life. The former group tended to be resistant to group influence because their emotional unbalance made them fixate the family attitude; and the latter, because of their lack of interest in group life.

The results of this investigation clearly demonstrate the importance of the social factor in shaping attitudes. To what extent the social factor operates as a force, however, varies not only with intellectual status, but with personality makeup as well. Socially minded individuals tend to climb on the bandwagon, and, once they are on, they may be as serious in their attitude as the ones who influenced them.

The factor of social pressure is always present in employee groups. Many individuals join a union just to go along with the crowd. However, their loyalty to the union need not mean lack of loyalty to the company. If management assumes that union affiliation indicates lack of employee co-operation, it may be ignoring the fact that social pressures are operating. Loyalty to one's group is an important kind of social pressure.

The above-mentioned experimental studies illustrate some of the factors which function in attitude change and development. They not only show that trends in attitude can be measured, but demonstrate that attitudes are influenced by a variety of specific conditions. Unfavorable employee attitudes likewise have their causes, and remedies can be found most readily if these causes are understood. Frequently, when management introduces new methods, it is surprised to find widespread opposition to the change. The introduction of a retirement plan, labor-saving devices, safety methods, a new wage plan, a closed-shop agreement

with a union, the employment of Negroes, a change in job classification, the length of the work-week, or a change in the duties of foremen may be opposed even when the employees stand to gain by the change. To expect a logical response or one which conforms to the employer's attitude is to be psychologically naïve. Even a consultation with union officials may fail to give an accurate estimate of the general employee reaction to the change, for, although labor leaders may have a close contact with the attitudes of labor, they too may be misled because their own attitudes influence their interpretation of the situation.

Through the study of employee attitudes, management can test out the effects of certain changes and remove general as well as specific sources of irritation. Pay rates on specific jobs, the personality of a particular foreman, and apparent failure to recognize extra effort may be isolated sources of grievances which could be corrected if they were brought to the surface.

INDUSTRIAL PRACTICES

Industrial psychologists have recognized the importance of obtaining favorable employee attitudes. Opinion polls and attitude scales have been used to obtain information on specific subjects. Suggestion boxes, which employees may use to express grievances and to offer suggestions, and personnel counselors, who are available to employees for discussion of their problems, have served the purpose of giving management some idea of prevalent employee attitudes. The interview method, when properly handled, is highly effective in detecting the general attitude of specific employees, even though it is not reliable for obtaining factual information. In order that the interview may yield an accurate expression of attitude, it is important that the interviewer shape his inquiry so that it harmonizes with the interests of the persons he examines. The expression of attitudes, as well as their accuracy, depends upon the presence of a common goal. Obviously, honest opinions will not be expressed if the

employee runs the risk of putting himself at a disadvantage if he expresses certain attitudes, or if he feels that he is being cross-examined. The interview is particularly valuable in that it takes the whole individual into account and gives a general picture of the person's state of mind.[15] On the other hand, attitude scales are valuable because they measure group trends on a specific topic. It is desirable to utilize the interview for the purpose of attitude detection, both when employees are being hired and when they leave employment.

It is probable that the future will see a rapid development in techniques of personnel counseling and attitude control. Certainly, the companies which are pioneering in this field of application are finding their efforts well spent.

HABITUAL ATTITUDES

The analyses made by the Gallup polls show that public opinion varies with income, age, geographical location, religion, and political party affiliation. These factors not only influence opinions on subjects directly related to them, but also influence opinions on subjects which appear quite unrelated to any of the specific factors. For example, approval or disapproval of a political appointment may depend on any one or all of the above factors. Actually, none of them may be pertinent to proper performance of the appointee in his job. That such factors must be considered shows that people's opinions depend on influences other than reason or logic.

All the factors listed above relate to past experience. These experiences set up habitual attitudes which a person tends to maintain as long as possible. Because these habits are stronger in older men than in young men, the former, as a group, are more resistant to change than are the latter.

If, however, our attitudes were purely a matter of habit, they would eventually change when they ceased to work. Actually,

[15] W. V. Bingham, and B. V. Moore, *How to Interview*, pp. 247–256.

we find many people who maintain throughout life an attitude built up in their youth and who are greatly distressed because the world in which they live no longer fits with this attitude. It must be recognized that attitudes frequently persist despite their inadequacies.

Ordinarily, attitudes change quite easily as conditions change. This plasticity may be illustrated with an innocuous list of words.[16] If you read slowly down the list, the words shown below tend to become related.

glass
bottle
alcohol
noise
men in white coats

Note the tendency to fit the words together into a specific picture. This pattern determines the meaning of the words even to the point of giving the bottles a shape. If I now add *cat* to the list, there is some hesitation, but soon it, too, is incorporated. Let me now add *test tube*, *Bunsen burner*, and *microscope* to the list. For a short time these words are troublesome because they do not fit; then something happens. The first organization of a bar changes to a laboratory scene, and all of the words are again adequate and fit a picture. Note how the cat which strolled into the bar may now become one which is pickled in the alcohol you were enjoying. The waiters change to scientists, noise becomes a laboratory sound, and the bottles change in shape. A complete shift in attitude has caused a change of opinion about all the items.

Suppose the bar attitude corresponds to an attitude of running your business as you see fit. The added items may be unemployment, organized labor, war in Europe. To many, these are troublesome items, so they are kept apart from the other experiences. Failure to incorporate the added items in a new pic-

[16] This illustration is adapted from one used by Professor Max Wertheimer in one of his lectures on Thinking at the University of Berlin in 1926.

ture corresponds to maintaining the bar framework and keeping the added words as a separate list. In this way people successfully build up logic-tight compartments.

All of us could change from the barroom attitude to the laboratory attitude because our old attitude had not been fixated. We were, therefore, able to behave reasonably. To show why all our attitudes are not so plastic, it is necessary to show how factors other than habit fixate the attitudes we have previously acquired. These other influences with which we must deal are the product of frustration. This factor is of particular importance, not only because it fixates attitudes, but because it determines their nature as well. We shall find that it is also a basic factor in developing a powerful labor movement.

4 FRUSTRATION AS A FACTOR IN FORMING ATTITUDES AND DEVELOPING SOCIAL MOVEMENTS

THE NATURE OF FRUSTRATION

A PROBLEM arises whenever a person is confronted with a situation in which his knowledge and learned techniques fail to produce the results which he desires. The healthy and mature reaction to such a situation is problem-solving behavior. This behavior replaces habitual reactions and is characterized by variability in action and new approaches in thinking. The tendency to break from the old ways of doing things often leads to a new activity or a discovery which solves the problem.

Although a problem situation ordinarily provokes creative thinking, it may sometimes serve to frustrate the individual to whom the problem is presented. Persistent interferences which disrupt the smooth performance of our habits and interfere with the attainment of our goals may sidetrack the healthy reaction and become sources of frustration. Whether or not a given interference will produce symptoms of frustration depends upon the individual's tolerance, his previous history of frustration, the pressure under which he is functioning, and his interpretation of the situation. We are also more likely to be frustrated by an interference caused by another person than by one caused by a physical object, because we are more likely to experience people as interferences than as problems. Since a child does not make this distinction as readily as an adult, he is about as likely to be frustrated by his blocks as by his mother. This does not mean

that frustration in adults is always dependent upon human interference. Unemployment, a fire, or a stalled car can serve the purpose when the tolerance is not very high or when there is pressure in the situation demanding that the problem be solved. The absolute necessity of finding a solution to a problem, or the anticipation of punishment if the problem is not solved, tends to make problems frustrating situations.

When a situation becomes frustrating to the individual, his behavior undergoes a distinct change. What previously was healthy, unemotional activity now shows a degree of emotionality and unreasonableness. Variable and constructive behavior is replaced by stereotyped and destructive behavior. In extreme cases, the behavior becomes quite pointless in the sense that nothing positive is gained. However, such activity sometimes obtains a valuable end in that the source of frustration is overcome. In such cases the behavior must be called adaptive. We recognize, therefore, that the symptoms of frustration are not necessarily undesirable and that a distinction must be made between adaptive and unadaptive expressions of frustration.

Previous writers, in general, have failed to accept a qualitative distinction between goal-oriented behavior and behavior arising out of frustration. The following discussion is guided by the theory that frustration and motivation represent two distinct sources of action in the individual. At certain times, one of these mechanisms dominates and controls the behavior; at other times, the other may take over. Which psychological process is brought into function will depend upon the individual's makeup as well as upon the situation. To understand the behavior at any particular time we must know which mechanism is dominating. We understand a man's behavior when he commits a crime, provided we can discover his motive. Likewise, we can better understand a man's actions when he attacks an innocent bystander if we know something about his frustrations. Since such an attack does not achieve a goal, the behavior is pointless when we ap-

it is difficult to convince such a person that his behavior has been unreasonable and out of touch with reality.

The different symptoms of frustration frequently occur in mixed form; hence they are sometimes difficult to recognize unless one knows what to expect. They are presented separately for the purpose of clarity, not because they represent different stages through which the individual passes.

AGGRESSION

Aggressive behavior is a form of attack.[2] Such behavior occurs when one resents interference and does not react to it as a problem. Ordinarily, this attack would be one of physically striking at the interference. The motorist who strikes another for bumping into his car, and the Japanese soldier who slaps faces of prisoners when they do not divulge information, are examples of this. However, training has, for the most part, inhibited such physical attack, so we frequently attack or abuse with words. The aggression may appear in a disguised form, as when one attacks another's reputation. In such a case the source of the frustration might not be readily apparent from the behavior. One workman may gossip about the quality of another's work, his home life, or what not, and the reason may lie in the other's ability to make the better impression on the boss. When one person makes violent charges against another, we can be reasonably sure that frustration has instigated these attacks. Rumors about a prominent person's health and sanity are more likely to originate in frustrated men than in socially well-adjusted individuals.

When aggression against the frustrating agent is prevented, the aggression may be directed at substitute objects. A foreman may bawl-out a workman; the frustration thus evoked in the workman may cause him to go home and abuse his wife. In his recent book, the CBS war correspondent, Smith, describes how

[2] J. Dollard, L. W. Doob, *et al.*, *Frustration and Aggression.*

the German people became abusive to each other on the subway.[3] The least incident would cause a whole coach-load of passengers to take sides and participate in an argument. The German people could not attack the source of their frustrations, so they relieved themselves on substitute objects. The attitude of a man who is described as having a "chip on his shoulder" is an attitude of aggression. When we understand him, we will probably find that he has a history of frustration. It may go back to his early childhood, be caused by his small stature, his deficiencies at work, or his family life. School bullies are frequently boys who fail to compete successfully with the other children in class work. Remedial work in reading may result in a marked change in their social attitudes. We often find the abusive foreman to be rather decent when we understand his problems.

The attack on substitute objects often takes the form of scapegoating, in which certain individuals or groups tend to be blamed for social evils. In such cases propaganda or leadership singles out the substitute object of attack and the aggression tends to be confined to this object rather than to be distributed indiscriminately. The relationship between scapegoating and frustration is suggested by the fact that scapegoating becomes more prevalent during periods of widespread unrest, dissatisfaction, and worry.

The expression, *aggression* in behavior, must not be confused with the common term, *aggressiveness*, which is frequently used to designate dominance, initiative, or self-reliance. Aggression in behavior has here been used to denote the presence of attack and destructiveness in man's actions.

It should not be assumed that aggression is necessarily undesirable or unadaptive. An attack on an obstruction, be it an enemy or an object, may remove it and permit the individual to resume progress toward his goal. It is such behavior which has aided lower animals to survive in the struggle for existence. In man, this primitive and individualistic behavior is of less value

[3] H. K. Smith, *Last Train from Berlin.*

because, in his case, survival depends to a greater degree upon reason and co-operation.

When aggression is directed toward obstacles which cannot be overcome, the aggression actually results in further frustration rather than in attaining relief. This happens when the obstacle strikes back. Thus, frustration is piled on frustration, and the behavior must be regarded as unadaptive.

Substitute objects are frequently attacked under these conditions, but this behavior is also unadaptive in that it is not directed at the source of the frustration. The substitute objects, when they happen to be other people, also strike back. Since they are frustrated by the attacking individual, they may direct their aggression against him. Such an individual soon becomes regarded as an anti-social person; hence he is socially undesirable. This position in society serves as a further source of frustration, and, instead of having solved his original problem, he has acquired more problems to solve.

The attitudes of frustrated people also reflect aggressiveness, in that such people tend to be on the defensive. They interpret compliments as insults, are oversuspicious, and want to get even with someone. These attitudes may prevail only in the frustrating situation and influence opinions about a few people, or, like other behavior traits, the attitudes may become quite general and apply to innocent bystanders.

Symptoms of aggression commonly met in industrial employees are excessive criticism of management, constant voicing of grievances, damaging of equipment, inability to get along with others, absenteeism, and, as we shall see later, the joining of militant unions. The management expresses its aggression by enforcing stricter discipline, imposing penalties of all sorts, attacking labor legislation, justifying dishonest tax reports, and opposing labor organization. Whether or not the aggression expressed justifies the frustration is quite beside the point, since justice for the frustrated individual is what he sees it to be. A man can readily

prove to his own satisfaction that he is underpaid, but the cause of the dissatisfaction may be the frustration arising from unpaid hospital bills, an invalid wife, or losses in gambling. In correcting the situation, however, it is desirable to know whether the aggression is directed toward the source of frustration or toward scapegoats. Sometimes management is labor's scapegoat and sometimes labor is management's scapegoat.

REGRESSION

Regression is a breakdown of constructive behavior and represents a return to childish behavior. In extreme cases, adults regress to the infantile stage and must be treated as babies. Even their speech and habits of cleanliness are those of infants.

That regression may be produced experimentally by frustration was demonstrated at the Iowa Child Welfare Station.[4] When children were deprived of certain toys to which they previously had access, their play with the remaining toys became more primitive than when such frustration was not present. This mild frustration caused the average child's play to become like that of a child one and a half years younger. For example, a toy truck, which before frustration was used to haul a doll about in complex play activity, was now pushed around in a simple and unimaginative way. Evidence of aggression was also found in these studies, frequently combined with regression. That more persistent and more intense frustration would have increased the symptoms can hardly be doubted.

Smith describes the Berlin subway riders as acting like children. If someone's elbow accidentally jabbed another's back, the latter threatened to report the offender, claiming he could cause trouble because he knew someone high up in the Party. Tattletale behavior is both regressive and aggressive when it appears in adults. Men who resort to name-calling, when engaged in an argument, offer perhaps the most common instances of regression.

[4] R. Barker, T. Dembo, and K. Lewin, *Frustration and Regression.*

Longing to return to the past as a place of refuge and being unwilling to face the future reflect a regressive or childish attitude. The baby is a creature of habit and is unwilling to accept the new. He must have his own bed and even his own dishes if he is to feel secure. When men feel that what was good enough for their fathers is good enough for them, they are resorting to childish attitudes. One need merely examine the kind of situations in which this sort of attitude prevails to see the relation between regression and frustration. This desire to return to the past is most likely to be found in those who experienced security there. It is not surprising, therefore, that an attitude of a return to the "good old days" is more likely to be found in the people who, in their childhood, experienced economic security than in those reared under conditions of privation.

Another regressive trait is suggestibility. One can easily suggest ideas for action to a child because he is uncritical. A critical attitude is associated with reason. If we regress to a more primitive state, we tend to lose our critical ability and become suggestible only to the extent, however, that the suggested behavior is not contrary to other primitive tendencies.

It will be seen that regression serves no useful purpose. In the development of children, the desire to grow up, to want to be older than they are, is recognized as a healthy sign. Adequate adjustments in childhood are a safeguard against regression in later life.

Signs of regression in industrial employees are loss of emotional control, "following the leader," primitive social organization, lack of responsibility, "horse play," unreasoned fear, and responsiveness to rumors. Likewise, men who pout, girls who cry easily, and workers who form childish cliques or gangs within the plant are displaying regressive behavior.

The bosses, too, show signs of regression. Managers, who refuse to delegate responsibility, are hypersensitive, cannot distinguish between reasonable and unreasonable requests, engage in broad

and unreasonable generalizations when they get on the subject of labor, and form blind loyalties for particular persons or organizations, show symptoms of regression. When intelligent people lose their perspective and fail to make obvious distinctions, it is because they have regressed, since inability to make fine distinctions is a sign of low intelligence. It is on emotionally loaded topics that distinctions most often fail to be made. Thus, the manager may pass unfavorable judgment on a man because he belongs to a union, and the employee passes unfair judgment on a supervisor because he generalizes that all supervisors are stooges.

ABNORMAL FIXATIONS

The term *fixation* is here used to designate a compulsion to continue a kind of activity which has no adaptive value. A fixated action is repeated over and over, despite the fact that the person knows it will accomplish nothing. Because of the compulsive character of such behavior, its replacement by more adaptive responses is prevented. Lady Macbeth's persistent hand-washing is a striking example of the abnormal fixation.

The relation between such persistent responses and frustration has been experimentally demonstrated in a number of studies.[5] These studies also show that continually forcing an animal to attempt to solve a problem that cannot be solved is an effective method for building up a state of frustration. Punishment, when

[5] G. V. Hamilton, "A Study of Perseverance Reactions in Primates and Rodents," *Behav. Monog.*, 1916, *3*, 1–65; J. A. Hamilton, and I. Krechevsky, "Studies in the Effect of Shock upon Behavior Plasticity in the Rat," *J. Comp. Psychol.*, 1933, *16*, 237–253, J. R. Patrick, "Studies in Rational Behavior and Emotional Excitement, II, The Effect of Emotional Excitement on the Rational Behavior in Human Subjects," *J. Comp Psychol.*, 1934, *18*, 153–195; N. R. F. Maier, N. M. Glaser, and J. B. Klee, "Studies of Abnormal Behavior in the Rat, III, The Development of Behavior Fixations Through Frustration," *J. Exper. Psychol.*, 1940, *26*, 521–546; R. W. Kleemeier, "Fixation and Regression in the Rat," *Psychol. Monog*, 1942, *54*, 1–34, N. R. F. Maier, and J. B. Klee, "Studies of Abnormal Behavior in the Rat, XII, The Pattern of Punishment and Its Relation to Abnormal Fixations," *J. Exper. Psychol.*, 1943, *32*, 377–398.

severe or when continued over a sufficiently long period, may likewise serve as a source of frustration and produce similar symptoms. A rat, for example, can be made to bang his head against a locked door hundreds of times without ever trying the unlocked door next to it. This behavior completely prevents the animal from ever learning a new adjustment which it would readily have learned prior to the frustration. Even if the animal is taught that he can avoid punishment by choosing the other door, he still cannot make that choice. The compulsion to perform the old response makes him unable to practice a new alternative that he knows is better.

Similar experiments have been performed with college students. After a period of mild frustration, their ability to learn a new problem can be reduced by one-half because one of the effects of frustration is to freeze old behavior and prevent the practice of new responses.[6]

Although a fixation may have the outward appearance of a normal habit, the difference between them becomes apparent when attempts are made to alter the fixation. A habit is normally broken when it fails to bring satisfaction or leads to punishment, whereas a fixation actually becomes stronger under these conditions. As a matter of fact, it is possible to transform a normal habit into a fixation by too much punishment. If the habit happens to be the making of a mistake, there is danger of making this habitual mistake even more frequent by excessive penalization.

It must be recognized, therefore, that punishment may have two quite different effects on the organism. On the one hand, it may have an effect opposite to that of reward, and, in this capacity, it may discourage the repetition of an act. On the other hand, it may function as a frustrating agent, and in this capacity, it may produce the fixations as well as the other symptoms associated with frustration. Because of this dual function,

[6] Unpublished study by Dorothy Marquart of the University of Michigan.

punishment is a rather dangerous tool, since it may produce effects which are the opposite of those desired.

Common illustrations of fixations occur in panic. In a burning building, for example, people persist in pushing at exits, even though the exits are barred. The more they push, the less opportunity for escape; nevertheless, this useless behavior continues.

Attitudes frequently exhibit the characteristics of a fixation. This was clearly shown in the Bennington study, in which it was found that 65 per cent of the persons who changed attitudes were definitely stable, while only 15 per cent showed marked symptoms of instability.[7] On the other hand, 32 per cent of the persons who persisted in their former attitudes were stable, while 37 per cent showed marked symptoms of instability when they entered college.

Because persistent attitudes are associated with situations in which frustration has occurred, they serve as evidence to support the view that attitude fixation and frustration are related. A man who has been frustrated by labor troubles reacts by referring to members of labor unions as a "bunch of Reds," insisting that they are associated with Russian communism. He hates everything which has this label. This hatred continues even after Russia has assumed an important part in saving our democracy from fascism. Certain attitudes thus persist despite the fact that they are illogical. It is these attitudes which make men irrational. On topics which are unrelated to frustration, the previously irrational individual may be calm and reasonable.

Many activities contain a combination of the features of aggression, regression, and fixation. To pass along the rumor that a prominent person is insane is aggressive action; to believe it shows suggestibility and lack of critical attitude, indicating regressive tendencies; to persist in the opinion, despite evidence to the contrary, shows fixation.

Examples of fixations commonly met in industry are to be

[7] T. M. Newcomb, *Personality and Social Change.*

found in individuals who are unable to accept change. Old methods seem best and are defended, whether they concern the nature of the method of work or the nature of industrial relations and economic outlook. Fixated individuals are blindly stubborn and unreasonable, although they may consider themselves merely persistent or cautious. They defend their refusal to change by building up logical defenses for their actions. Logic thus follows their decisions, rather than precedes them. Industrial firms which are relatively free from frustrating situations and have high employee morale are made up of individuals who *seek* new ways, rather than *fear* them. To them something *new* suggests something *better*.

RESIGNATION

Studies of unemployed people [8] and refugees,[9] in addition to revealing the traits already described, frequently contain evidences of a state of mind which we may describe as one of "giving-up." All forms of activity seem to be closed to the individual, so he surrenders. This is a frame of mind which oppressive rulers may desire to create. That inactivity and an attitude of resignation will continue when an avenue for action is made available to the individual is highly questionable. Resignation is probably a dormant condition, in which all aggression has been temporarily blocked. People in this state obviously have low morale and will remain socially neutral unless their mental condition changes.

In industry, the resigned individual is one who has lost hope of bettering his conditions. "There's no use to try to do anything around here," "I've stood it this long and can wait until I retire,"

[8] P. Eisenberg, and P. F. Lazarsfeld, "The Psychological Effects of Unemployment," *Psychol. Bull.*, 1938, *35*, 358–390; B. Zawadski, and P. Lazersfeld, "The Psychological Consequences of Unemployment," *J. Soc. Psychol.*, 1936, *6*, 224–251.

[9] G. W. Allport, J. S. Bruner, and E. M. Jandorf, "Personality under Social Catastrophe: Ninety Life-Histories of the Nazi Revolution," *Character and Personality*, 1941, *10*, 1–22.

"I've learned to put up with conditions," and "It's always been this way and it will always be this way," are characteristic statements of hopeless and apathetic employees. Such persons depress others and make no contribution to reform.

INDIVIDUAL DIFFERENCES

In discussing the symptoms of frustration, basic trends have been emphasized and differences between individuals have been submerged. That all people do not do the same things when they are frustrated, any more than they behave identically when they are motivated, goes without saying. The variations in behavior which may appear in frustrating situations have, at least, three basic causes. One cause of variation lies in the fact that different people may express any one of the four types of symptoms in different ways. Another is that certain people show a predisposition to display one symptom rather than some of the others. The final, and most important, cause is the fact that there are individual differences in susceptibility to frustration. Some individuals are less inclined than others to become frustrated, either because they view the situation differently or because they have a higher level of tolerance against frustration. As situations become more aggravating, a greater number of people shift from goal-motivated to frustration-instigated behavior.

The causes of the differences in behavior undoubtedly depend upon personality differences and, to some extent, upon differences in intelligence. Many of these differences must be attributed to heredity. Acquired differences will depend upon previous experiences (1) in developing emotional adjustments, (2) in learning to co-operate, and (3) in feelings of security and social position within a group.

The presence of individual differences complicates prediction in behavior; nevertheless, the general effect of frustration is that it causes certain changes in behavior. A knowledge of these

changes in behavior increases our understanding of individuals, as well as that of groups, because it furnishes us with certain principles. These principles aid in a recognition of the symptoms and indicate the kind of behavior we may expect. Although we cannot hope that they will allow us to predict with certainty, they do permit us to work with probabilities in our favor.

THE RELATION BETWEEN FRUSTRATION AND SOCIAL MOVEMENTS

COMMON FORMS OF SOCIAL ORGANIZATION

Most of the social organizations or social groups with which we are familiar are small and show a great deal of overlapping in their membership. The various influences they might exert on customs and the manner of living tend to neutralize each other. A heterogeneous assortment of social groups within a country may influence the lives of individuals, but they do not tend to make history. It is only when a large mass of people join in a single movement that they become a social force to be reckoned with.

Any important social movement can transform the social, political, and economic structure of a country. It is to the interest of the industrial leader, therefore, not to ignore these social trends.

Under normal conditions, social groups may be characterized as organizations of individuals having common interests or goals. These groups may be characterized as goal-motivated. People who wish to attain certain ends work together for a common purpose. They have leaders who represent them in their interests and whose duty it is to co-ordinate the activities. Athletic clubs, bridge clubs, university clubs, political clubs, religious organizations, prohibition societies, and the like, are common examples of social groups.

FRUSTRATION-INSTIGATED SOCIAL MOVEMENTS

It is also possible for a frustrated group of people to become

organized.[10] Since aggressive behavior tendencies are present in such people, they are susceptible to being organized or united around a pattern of aggression. We have already seen that no specific aggression is demanded by the frustrated individual; as a consequence, any form of aggression will appeal to him.

In *Under Cover*, Carlson has repeatedly emphasized the fact that the programs of subversive groups are hate programs.[11] These groups do not advocate reforms or goals, but, instead, confine their efforts to inciting attacks on certain individuals or groups. The author's descriptions of the leaders and the people who follow them leave little doubt that these organizations are primarily made up of frustrated persons. Many of them even have physical handicaps which may have embittered them. From the point of view of goal-motivated and socially adjusted persons, such individuals are abnormal. Part of the strength and success of these social movements lies in the fact that well-adjusted individuals are not attracted to their programs and pass them off as expressions of crack-pots until their own security is threatened. It is important to appreciate the danger of such groups before they become sufficiently powerful to serve as a threat.

The study of riots and mob behavior also reveals the attractiveness of destructive behavior to certain groups of people, once an avenue for such activity is opened for them or merely made apparent to them, and it is impossible to explain mob behavior merely by referring to the incident which released it. Frustrations and tensions on a wide scale precede these outbursts and are the underlying causes.[12] Incidents and suggestions for action precipitate, co-ordinate, and direct the course of aggressive action as well as furnish the security of group action.

That incidents are not the basic causes of mob action is appar-

[10] N R. F. Maier, "The Rôle of Frustration in Social Movements," *Psychol Rev.*, 1942, *49*, 586–599.

[11] J. R. Carlson, *Under Cover.*

[12] A. M. Lee, and N D. Humphrey, *Race Riot.*

ent from the fact that the extent of frustration is related to the frequency of mob behavior. It has been shown, for example, that in the Southern states the number of lynchings is closely related to the annual per-acre value of cotton.[13] Low income from the cotton crop is a frustrating condition; thus at times when low incomes prevail groups of people are readily organized around aggression toward the Negro.

The non-specific nature of the form which aggression may take makes it relatively easy to organize large numbers of frustrated people. Social movements of this type are potentially large and the program of action is destructive in nature. Such a movement can be very strong because the action of a large mass of people is synchronized.

The leader of a movement which is organized around a pattern of aggression is in a very powerful position. It is he who determines the form of the aggression. He is also in a position to time the action. The large supply of destructive energy generated by frustration is ready to be harnessed, and the leader may not only do the harnessing, but he may also do the driving. In this capacity he becomes a determiner of history if his movement comes to power.

The other types of behavior which are characteristic of frustration lend support to an organization built around frustration. Regressive tendencies make people suggestible and easily led; thus they become uncritical and are not likely to recognize inconsistencies. The tendency to fixate makes their behavior stereotyped, so that they can be made to persist in any activity in which they get started. Taken together, the effects of frustration make possible a fanatical type of social movement in which the individuals are relatively homogeneous and are dominated by hatred and destruction. They are persistent, irrational, and ready to follow a leader. Whether or not they will sweep away those things which are good or evil in society depends largely on circumstances

[13] Dollard, Doob, *et al.*, *op. cit.*, pp. 30–31.

outside themselves. As implied above, the leader is perhaps the most important single factor in determining the direction the activity will take. If the activity is directed at the source of frustration and successfully destroys it, social progress may result. If the activity is directed at innocent bystanders, such as racial minorities, social progress is impeded. If it is directed at groups of individuals interested in reform, social regression may occur. Frustration-instigated social movements thus constitute a social risk, since they are not oriented to a future goal. In so far as goals are mentioned in the propaganda of such movements, they are accessory factors which may influence some individuals not completely dominated by frustration.

It is such movements which develop into militant labor organizations, or they may even form the nucleus of a force from which violent revolution develops. It was such a movement that brought about the second World War. To suppose that leaders create unrest is to miss an important point. Unrest may be utilized by a potential leader, but the causes of unrest lie in the frustrations which are already there. No leader can organize a mass of well-adjusted people into an aggressive movement. A leader can use only the forces which are at his disposal. Under such conditions the imprisonment of one potential leader after another merely aggravates the situation. It may delay the organization of the movement, but such delay will only make it easier for the many potential leaders which will emerge as others are removed. These new leaders may become less and less responsible, since frustration will have been piled on frustration.

The manner in which frustration influences the character of a social organization is well illustrated by a comparison of the communistic and socialistic movements. The economic beliefs of communism and socialism are very similar, but the character of the two movements is quite different. The former is militant in nature, placing a great deal of emphasis on the overthrow of capitalism. The words "down with," which are so frequently

used in their slogans, are aggressive terms. Socialism, on the other hand, emphasizes the better life. Its slogans tend to describe goals. From the conduct of these two political parties, it seems reasonable to regard communism as primarily a frustration-instigated type of movement and socialism as largely a goal-motivated type. This distinction explains why communism has been the more vigorous movement. It gives the frustrated people an aggressive pattern of action rather than a promise of better things.

In countries in which economic frustration has been widespread, communism has played the more dominant part. In Russia, Germany, France, and China, where frustrations have been experienced by a large proportion of the populations, communism has been an extremely important force. In the Scandinavian countries, where frustration has been more limited, socialism has been more influential than communism. In the United States the influence of communism was greatest during depression years, and at no time has it been a great influence.

It should be pointed out, however, that the absolute standard of living does not determine the extent of frustration. Rather, it is the relative standard of living of people which determines the extent of their dissatisfactions. People do not experience deprivation if no alternatives are part of their past experiences. When, however, the standard of living falls, or when part of a population lives in luxury while another part starves, the alternative condition is experienced. Since frustration is always a reaction on the part of the individual, not a description of the situation to which he reacts, it is essential, in considering economic frustration, to determine how a man views his standard of living when he compares his status with that of others, rather than to determine what his standard of living actually is.

Because labor, when frustrated, is highly susceptible to being organized into a strong labor movement, it is desirable that industry avoid creating frustrating circumstances. If it opposes

unions which have goals, it frustrates them, and thus encourages the formation of a militant labor movement. The latter eventually will be no more interested in compromise than was Hitler at Munich.

Objective examination of industrial strife shows that labor movements become more militant as attempts are made to frustrate their activities. In industries where unions do not have to struggle for recognition, they actually co-operate with management. In these cases conciliation is the rule rather than the exception. Since unreasonable people are frustrated people, frustrating them further merely increases their destructive potentialities. To force them into submission in the hope that they will eventually become resigned and give up is psychologically unsound and dangerous.

EXAMPLES OF LOSSES IN GOAL ORIENTATION IN FRUSTRATED GROUPS

One may wonder why labor in some instances should refuse to co-operate with industry in the war effort, when its refusal actually amounts to co-operation with the enemy. The Fortune poll throws some light on this apparently contradictory behavior.[14] A poll of Pittsburgh workers shows the following to be most popular: the United States, President Roosevelt, the unions, and the United States Army. Their greatest dislikes are: the Japanese, the Nazis, "industrial engineers," and "dollar-a-year" men. Aggression against the latter two is in conflict with production goals. Labor may wish to exert itself to help the Government, but, if it cannot do this without helping representatives of industry, it is faced with a dilemma. To remove this conflict, guarantees should be made that industry will not benefit by labor's extra effort. Asking labor representatives to aid in planning a production program would also help to remove suspicion.

This state of affairs is similar to the political issues in India. The people of India actually played into the hands of Japan when

[14] "What's Itching Labor?" *Fortune,* November, 1942, p. 230.

they refused to co-operate with Great Britain. This is unreasonable, since a Japanese-ruled world would be far worse for them than one ruled by the British. India's aggression against England took precedence over the behavior of choosing between two alternatives. We must realize that this kind of behavior is caused and that it can be anticipated. We, in this country, have not experienced the frustrations which are shaping the actions of the people of India. For this reason, we were inclined to judge their actions as unwise, if not wholly unreasonable. If the situations were reversed, they would be surprised at our emotional blindness. The unfrustrated individual is in the best position to choose intelligently, but it is not logical to expect frustrated people to behave rationally. Many mistakes are made when we assume that world events are shaped by reason and by behavior based on intelligent choice. When we make this assumption, we disregard the nature of man.

Like India's reaction to England, labor's aggression against management may dominate its behavior, causing it to be unresponsive to goals set by the employer. Workmen may turn out defective parts to satisfy a grudge against management, unaware of the injury this action will cause to society in general. Management conducts itself in a similar fashion when it is aggressive against labor or government. Frequently, the attempts to blame one another for delays in production are largely acts of aggression.

If labor groups, associations of manufacturers, and other interests have separate sources of frustration, they are capable of being organized into separate social movements, each of which is militant in nature. In this manner a nation may be broken into a number of small aggressive groups. It can thus be divided against itself and fail in the attainment of its common goals.

THE I.W.W. AS A FRUSTRATION-INSTIGATED LABOR MOVEMENT [15]

The Industrial Workers of the World (I.W.W.) was a labor

[15] This section is based upon material prepared by Martha Klee, of the University

organization which conforms closely to our criterion of a frustration-instigated social movement. Its membership consisted largely of migratory workers in the California industries and immigrant workers in the industrial centers of the United States. The lot of the migratory workers in California was one of economic privation. Over two-thirds of them lived below State Board of Health standards, and nearly one-third lived under conditions of filth and destitution.[16] Employment was intermittent, so that security, at even low levels of subsistence, was lacking. Migratory workers suffer further infringements on their security in that they lack or lose family ties and have few opportunities to improve their condition.

The immigrant workers settled primarily in industrial centers, where they frequently made up 40 per cent of the population. The condition of being an immigrant, in itself, is a source of frustration. Being unskilled, and hence barred from the American Federation of Labor (A. F. of L.), and being required to work long hours at low pay were additional factors which placed these individuals in frustrating circumstances. It may be expected, therefore, that the conditions of deprivation described above would yield a large percentage of frustrated individuals, even if they were not by nature highly unstable.

Let us now examine some of the symptoms in the behavior of this group. According to records, the I.W.W. was involved in more than seventy-two strikes and numerous free-speech fights between 1905 and 1917.[17] This is a fair figure, considering the lack of funds and the size of the organization. Seldom did the organization exceed fifteen thousand members in good standing and the turnover averaged over 133 per cent for a ten-year period. In addition, the I.W.W. talked many more strikes than it engi-

of Michigan. I am grateful for her kind permission to summarize her interpretations of the existing literature and newspaper accounts.

[16] C. H. Parker, *The Casual Laborer and Other Essays*, pp. 61–124.

[17] P. F. Brissenden, *The I.W W : A Study of American Syndicalism*, pp. 347–348 and 366–367.

neered. That the strikes often failed to win better conditions, but did not discourage the membership, indicates that the strikes were acts of aggression rather than goal-directed behavior. At the same time this persistence of effort shows fixation.

The lack of goal orientation in the aggressive behavior is further illustrated by the violent attacks on the A. F. of L., the destructive slogans ("Kick your way out of slavery," "A kick in time saves nine," and so on), and the attacks on persons not belonging to the I.W.W. The latter attacks included kicking men out of box cars if they lacked I.W.W. cards and driving chisels through the radiators of cars which belonged to non-members.[18] Lack of a constructive aspect in the attack behavior clearly brands it as of the frustration-instigated type.

Although the strike may be used as a means for improving working conditions, it does not seem to have served this purpose in I.W.W. circles. Rather, the strike was a means of obtaining membership. In some instances membership rose from one thousand to ten thousand during a strike.[19] Following a strike, membership fell off rapidly. This rise and fall in membership shows that the pattern of aggression of the I.W.W. served as an attraction for frustrated individuals.

Regression in I.W.W. activity was apparent from the tendency of both its membership and its leaders to worship heroes and martyrs. Lack of realism, another regressive feature, was apparent in their inability correctly to evaluate situations. This failing led to many mistakes in tactics and to many ill-timed strikes. This was particularly true as problems and situations changed after the first World War. The insistence on continuing the same tactics and the inflexibility in its program evidenced fixation and contributed to the organization's downfall. Gambs's description was very appropriate in this connection, when he said, in 1932, "The I.W.W. is willing to change the world, but it is not willing

[18] J. S. Gambs, *The Decline of the I.W.W.*, pp. 109 and 181.
[19] See references in footnotes 16 and 17, pp. 114 and 282–290, respectively.

to change itself. Members with constructive suggestions for change and adaptation to post-war conditions are not encouraged to express their opinions. Inflexible, dogmatic, fatalistic, that is the I.W.W. today." [20]

Although fixation may have an advantage in that it gives staying quality, it cannot continue to be an advantage over a long period of time, since circumstances change. It is for this reason that the leaders of a frustration-instigated social movement must remain unfrustrated. They may effectively utilize what they know about frustration in order to organize individuals, but they themselves must remain goal-motivated so that they can meet new problems. The I.W.W. did not recognize that gains in working conditions reduced frustration and made the destructive tactics less appealing. Some of their membership thus drifted to goal-seeking unions, while the more frustrated found satisfaction in the more militant program of communism.

During this same period the A. F. of L. was organizing skilled workers. In comparison with that of the I.W.W., its program emphasized higher wages and better working conditions, rather than revolution and overthrow of capitalism. Instead of speaking of "taking the wealth you are making," the A. F. of L. asked, "Do you want a better home and more things to make your family happy?" Their leaders seldom became heroes, and their meetings were less enthusiastic.

In general, one may say that the type of unions a society will develop depends largely on the kind of economic and social conditions that exist. Leaders do not determine the type of labor movement that emerges, rather the conditions determine the kind of leadership which will spring into power. A society which criticizes the militancy of its unions is really criticizing itself, since it creates the conditions which make for militancy.

[20] Gambs, *op. cit.*, p. 206.

5 MORALE

GENERAL CONSIDERATIONS

One of the authorities on the subject has defined national morale as an individual attitude in a group endeavor.[1] This statement implies that both personal and social features are involved in the mental condition which we call morale. To have high morale, this writer believes (1) that the individual must possess firm convictions and values which make life worth while for him so that he has the energy and confidence to face the future; (2) that he must be aware of a job to be done to defend or extend his store of values; and (3) that his values must be in essential agreement with those of his group, and there must be a co-ordination of effort in attaining objectives.

If frustration-instigated behavior implies a loss in goal-striving and high morale implies a sustained determination to attain goals, we may think of good morale as resistance to frustration. A person with high morale can be placed in frustration-inducing situations without readily succumbing to frustration. His frustration threshold is high; therefore, he tends to react to obstacles as problems.

Poor morale is characterized by an attitude of apathy or resignation. Either goal interest is absent, or the obstacles between the individual and the goal are regarded as insurmountable.

[1] G. W. Allport, "The Nature of Democratic Morale," in *Civilian Morale* chap. I, pp. 3–18.

When one sees all obstacles as impassable barriers, he is highly susceptible to frustration, and such symptoms as resignation, regression, and fixation tend to appear. Poor morale, however, protects against frustration when goal interest is reduced to a minimum. We have already seen that the blocking of goal-striving behavior is one aspect of a frustrating situation. If goal interest is at a minimum, interference with reaching the goal produces only a limited experience of deprivation. In such a case low morale is a kind of protection against the original situation; the individual may become quite unrealistic and refuse to meet the situation. The absence of aggression in low morale suggests that the obstacle (which is often attacked) has become less aggravating because goal interest has declined. In such cases the person is without hope and he escapes by shutting out the world.

From this description, it is apparent that people with the same experiences may have different degrees of morale. Inborn personality differences which bring about differences in energy, determination, and emotional stability influence stamina. Likewise, bodily condition is important. Good health, proper food, and adequate rest also have a direct influence on stamina; so, too, has the environment in which a man works. Some work situations are more conducive to good morale than others. Such factors as the company attitude toward the employees and society in general, the type of foreman, the sanitary facilities, the lighting, ventilation and attractiveness of the shop, and many other conditions all give the factory an atmosphere which influences the morale of the worker. Finally, past experiences, such as discouragements at home and at work, former insecurities, and status in society, determine the goals for which a man will work.

Many of these factors are controlled or influenced by the employer. He is, therefore, in a position to raise or lower the morale of his employees.

One aspect of employee morale is the attitude toward the employer. Scales for measuring morale in terms of attitude to-

ward the company have been developed.[2] Table 2 reproduces the items which were found to be diagnostic by one investigator.[3] Employees were asked to check all statements with which they were in agreement. In order to obtain honest evaluations, the voting was anonymous. As pointed out in our discussion of the measurement of attitudes (page 48), each statement has a scale value which has been experimentally determined. The scale values for each of the statements are shown on the right in Table 2. An employee's attitude toward the company is expressed by the average of the scale values of the statements which he

TABLE 2. STATEMENTS USED IN UHRBROCK'S SCALE FOR MEASURING ATTITUDE OF EMPLOYEES TOWARD THEIR COMPANY

Statement	*Scale Value*
I think this company treats its employees better than any other company does	10.4
If I had to do it over again, I'd still work for this company	9.5
They don't play favorites in this company	9.3
A man can get ahead in this company if he tries	8.9
I have as much confidence in the company physician as I do in my own doctor	8.7
The company is sincere in wanting to know what its employees think about it	8.5
A wage-incentive plan offers a just reward for the faster worker	7.9
On the whole, the company treats us about as well as we deserve	7.4
I think a man should go to the hospital for even a scratch, as it may stop blood poisoning	6.3
I believe accidents will happen, no matter what you do about them	5.4
The workers put as much over on the company as the company puts over on them	5.1
The company does too much welfare work	4.4
Soldiering on the job is increasing	4.1
I do not think applicants for employment are treated courteously	3.6
I believe many good suggestions are killed by the bosses	3.2
My boss gives all the breaks to his lodge and church friends	2.9
I think the company goes outside to fill good jobs instead of promoting men who are here	2.5
You've got to have "pull" with certain people around here to get ahead	2.1
In the long run this company will "put it over" on you	1.5
The pay in this company is terrible	1.0
An honest man fails in this company	0.8

[2] R. S. Uhrbrock, "Attitudes of 4430 Employees," *J. Soc. Psychol.*, 1934, *5*, 365–377; also H. B. Bergen, "Finding out What Employees Are Thinking," *The Conference Board Management Record*, April, 1939.

[3] Uhrbrock, *op. cit.*, pp. 367–368.

checked. In this scale, a high score would indicate good morale. It was found that the average score for foremen was 7.19; for clerks, 6.89; and for factory workers, 6.34. Thus, within the same company occupational status influenced the attitude toward the company. Of interest also is the fact that women workers were more favorably inclined toward the company than were the men.

By the use of such scales, one can readily determine the factors which influence the employee's attitude toward the company, as well as the degree to which each factor influences it.

Investigations show that there are great variations in general employee morale from one company to another. In one study, data were obtained from 49,962 rank-and-file employees in 141 different groups from all sections of the country.[4] It was found that the average morale score for the different companies showed significant variations and that the employers could influence the score to an important degree. Such factors as type of work performed and wage level were relatively insignificant, while the type of boss and various forms of job satisfaction were very important. The importance to morale of an employee's immediate superior was apparent from the fact that departmental variation within a company was more marked than the differences between companies. Even when pay and hours of work were matched, wide departmental variation was apparent, and analysis revealed that the conduct of the immediate superiors was the important factor.

Job satisfaction was shown to be important by demonstrating that morale was definitely higher among employees who were satisfied than among those who were dissatisfied on the following specific items:

1. A fair hearing and square deal on grievances
2. The prospects of a satisfactory future

[4] R. L Hull, and A. Kolstad, "Morale on the Job," in *Civilian Morale*, chap. XVII, pp. 349–364.

3. The company's knowledge of the employee's qualifications and progress
4. Recognition of and credit for constructive suggestions offered
5. Friendly and helpful criticism of work or correction of errors
6. Pay increases when deserved
7. Recognition and praise for unusually good work
8. Selection of best-qualified employee for promotion when vacancies arise
9. Amount of work required not unreasonable
10. Pay at least as high as the going rate for the same type of work elsewhere
11. Freedom to seek help when difficult problems arise in work
12. Freedom from unjust reprimand
13. Satisfactory daily working hours
14. The company's vacation policy

The importance of these items in their influence on morale is in the order listed. It will be noted that many of the psychological satisfactions tend to be higher in the list than do the purely material ones.

We already know some of the general factors which are conducive to good morale. More specific factors or techniques for its encouragement will be developed when a greater number of industries undertake its study. Some of the fundamental psychological factors which tend to produce good morale are discussed below. The influence of long hours, inadequate food, and lack of time off will be discussed in our treatment of psychological fatigue.

PSYCHOLOGICAL FACTORS INFLUENCING MORALE

From the data obtained in a number of investigations, certain factors emerge as basic to good morale. The more important of

these are mutual sacrifice, participation in group activity, the experience of progress toward a goal, tolerance and freedom within the group, and confidence in leaders.[5] It will be seen that most of these factors imply group relationships. This means that morale is largely a social phenomenon and is subject to social influences. When social situations are not involved and we are dealing with an isolated individual, we speak of high motivation, persistence, and self-confidence. Since these individual conditions are related to morale, as well as a great many other work conditions, they are discussed in other connections. The list of factors given above does not by any means include all the factors which influence morale. We have selected from the literature those which seem most important, and which, at the same time, influence the industrial worker. Although these factors have previously been treated in a more general setting, we have taken the liberty of modifying them to some extent to fit them into the industrial scene.

MUTUAL SACRIFICE

People will tolerate deprivation and hardship if all are subjected to the same conditions. However, when some are given special privileges or are shown favoritism, the others are demoralized. The feeling that some profit from the war, while others sacrifice, became evident soon after our entry into the conflict. In war plants, workers become critical of each other when some fail to co-operate or exert themselves; thus a few isolated instances of loafing may serve to discourage the efforts of a large group.

The importance of the factor of mutual sacrifice to industry is shown by the fact that unfairness is a common complaint of workers against their employers. Whether or not this criticism is justified is beside the point. The facts are that men often do feel that they are treated unfairly and that the frequency with

[5] G. Watson (editor), *Civilian Morale*, pp. 3–18; 30–70; and 365–401.

which this feeling occurs varies from company to company. Since all who complain do not work for the same company, it is impossible for an unpopular firm to avoid responsibility by saying that complaining of unfairness is an inborn characteristic of working people. When the employer explains to the employees the necessity of taking certain actions, adopting certain policies, or insisting on a high degree of accuracy, the number of such complaints decreases. The level of morale is raised if the group knows why certain things are done. It is also desirable that employers have definite rules and standards to guide them in the selection of individuals for special treatment or promotion, so that the men do not suspect them of showing favoritism.

It is generally conceded, therefore, that sacrifice need not be a frustrating factor if deprivation is fairly and uniformly distributed. Likewise, promotion need cause no marked disapproval if it is based on merit.

PARTICIPATION

When groups of people work together, morale is highest if each one is not only allowed, but is actively encouraged, to participate in achieving a common goal. Every person should be made to feel that his efforts are important, for, when a person feels indispensable, he is most likely to co-operate.

When men work together in relatively small groups or gangs, it is desirable that they be matched as well as possible in ability. If one man is inclined to feel inferior because of his lesser ability or because of criticism by the others, he feels that he is in the way. Absenteeism and dissatisfaction are likely to occur most frequently among men who develop this feeling of inferiority. The excuses they present for their behavior will be characterized by attempts to cover up their attitude of inferiority. The admission of inferiority represents even lower morale, since it indicates a loss of self-respect.

When men work in fairly close quarters, it is desirable that

those who are congenial be placed side by side. Congeniality and group spirit should be encouraged, for there are many kinds of work where conversation does not interfere with efficiency. Friendships within a department are to be encouraged, as the Hawthorne plant study revealed. This is one of the reasons why many firms have found it worth while to develop recreation centers. On the other hand, arbitrary rules prohibiting various activities do not serve disciplinary purposes; rather they act as irritants.

Any condition which lowers a man's dignity discourages free participation in group effort. When men are content to loaf, it is not always because they are lazy, but often because their morale is low. Loafing, as such, is not pleasant, and therefore has no motive. Bawling-out men for loafing does not raise their morale, although it may modify the manner of loafing.

EXPERIENCE OF PROGRESS

The group spirit remains high if the joint efforts result in progress. Advancements or promotions always have a stimulating effect. It is not necessary, however, to raise wages and promote repeatedly to give the experience of progress. In industry, public recognition of efforts and progress in the war effort serve the purpose. When an army general gives credit to the workers for building planes which outfought the enemy, he is building morale. Crediting the specific individuals who worked on a liferaft which saved a hero will make the feeling of progress very real. On the other hand, blaming workers for poor production lowers morale.

One very effective method of apprising men of their progress and of their standing in the group is the making of a periodic report by the supervisor. Under this method, for instance, each man might have an interview with his supervisor twice a year, and, at these interviews, he could learn how his work was observed and evaluated. This method would bring each man to the attention of the supervisor, including the average man, who is likely

to remain unnoticed because his work is neither bad enough nor good enough to attract attention. Even the man who does good work may be overlooked, for, while most supervisors react to mistakes, they too seldom take the trouble to give praise for good work.

That praise is most conducive to improvement in work has been experimentally demonstrated. (See page 261 for details.) While criticism also may cause improvement in the work of some people, it may bring about a reduction in the work of others. Since public criticism injures the ego more than does private criticism, the former is likely to produce more undesirable effects than desirable ones. These effects on workers are undoubtedly related to morale, as was indicated by the list of items given on page 83 f.

TOLERANCE AND FREEDOM

In order to develop co-operation and group spirit, tolerance and freedom are essential. The work atmosphere plays an important part in developing these conditions. Where everyone is under pressure and the atmosphere is authoritarian rather than democratic, tolerance and co-operation are rarely found. Frustration does not develop tolerance. If efforts are made to minimize the frustrations in a work situation, men will have fewer aggressions to take out on each other. In free situations, men get to know one another. Familiarity with a man and his problems makes one tolerant of him. Lack of such knowledge makes for critical and intolerant attitudes. Fault finding and nagging over minor details are signs of intolerance and they restrict the free behavior of others.

TYPE OF LEADER

In industry, the supervisors of men are the leaders. The characteristics they will have can be made largely a matter of com-

pany policy. In order to create confidence in its employees, the company should make it a policy to select supervisors who are fair, socially minded, and capable. Some individuals have a knack for handling men, and this is perhaps more a matter of personality than of superior intelligence. Leaders should have a natural interest in people and be emotionally well adjusted. The essential qualities can be improved by training, but training alone will not make up for deficiencies in intelligence and personality. By combining selection with training, a firm can greatly increase the effectiveness of its supervisors, and thereby also raise the level of morale among its employees.

SUPERVISION AND MORALE

The fact that the level of morale differs greatly from one company to another demonstrates that low morale is not something for which management can blame its employees, since management can alter the degree of morale. A survey based on interviews with employees in war plants making similar parts and having like rates of pay shows that employee morale is closely associated with management's attitude toward its employees.[6] For example, one manager complains that his employees "do not know there is a war on." He tells them to "snap out of it," but there is no response. The girls are a particular headache to him. They want rest periods and more comfortable seats. In exasperation, he tells them, "Nothing doing. You've got good seats and you don't need rest periods on a sitting job — I've got stuff that has to be delivered." Then finally he tells them they can take the job "as is" or leave it.

In contrast, another manager says, "We're all working toward one goal — winning the war." This manager talks things over with his employees, he appreciates their efforts and refers to them with pride. When his girls "beefed" about stools being too low, he had platforms built beneath the stools. He listens to all of

[6] D. W. Baruch, "Why They Terminate," *J. Consult. Psychol.*, 1944, *8*, 35–46.

their problems, even personal ones. His employees feel important and their work shows it.

Here we might ask which is the cart and which is the horse? Do employees shape the attitude of the manager or does the manager shape the attitude of the employees? As soon as we put these questions, we have made a distinct step forward — we are no longer blaming, but are looking for causes. It is the finding of causes which leads to the solution of problems.

The conclusion drawn by the author of the above-mentioned survey was that the supervisor

> becomes the pivot around which many things revolve. The type of personal contact which he builds can obviously make or break morale. . . . The possibilities, however, of raising morale would appear unlimited if management and unions would see to it that those representing them in closest contact with the workers possessed real human understanding.

Interviews conducted by the author clearly show that the majority of expressed grievances involve a supervisor directly or indirectly. Complaints of favoritism are common and vary from one supervisor to the next in the same department. When employees say their boss makes them feel cheap and treats them like children, they are describing a kind of personal treatment that injures their pride and self-esteem. Often they assert that the supervisor gossips about them. In such cases you can be sure that they feel that the talk about them was unfavorable and that they do not trust their supervisor. The suspicious supervisor, who is ready to find fault and blame without investigation, invariably seems to be the one who can give reasons why he cannot trust his employees and must watch them every minute. Likewise, he is invariably the one who has difficulty in meeting schedules. How can he learn about human nature from his employees when he himself is a great factor in determining the kind of personality his employees express? The psychologist

recognizes that personality traits are greatly influenced by the situation and are not to be regarded as purely descriptive of the person.

The truth of this statement becomes apparent when we recall the person who is congenial at work and disagreeable and dominating at home. We ourselves co-operate with some people and not with others. We are happy and friendly in some groups and miserable and disagreeable in others. The unco-operative employee may be very co-operative in union activities. Which of the conflicting personality traits can we truthfully assign to the individual? Must we not recognize that each of us in part influences the personality which our friends and associates express?

THE FOREMAN AND MORALE

The foreman, as well as other supervisors, is in a key position for influencing morale, largely because he is in a position to know the men and their work at firsthand. He can make them feel either important or superfluous. By being fair and impartial, he can instill in the men values and standards which will be respected. By welcoming ideas and praising men for their efforts whenever possible, he can make his men feel that they are part of the organization. His patience and tolerance can set an example and create an atmosphere which will encourage mutual respect for the rights of others. If he gladly delegates responsibility, he will make possible greater participation, which, in turn, will result in the development of a greater sense of responsibility in the men. He should know his job, and, if he is to maintain the respect of his workers, his knowledge should be superior to theirs. This superiority also makes him less prone to be on the defensive. A man who has confidence in his ability is not afraid to delegate responsibility or to give credit where credit is due. Taking credit for the efforts of others and fearing to delegate responsibility are indications of feelings of inferiority.

From the foregoing remarks, it will be clear that the position

of a foreman as a driver is a thing of the past. The modern foreman should function as a leader. In this capacity he becomes responsible to the men as well as to management. His attitude should be that he is representing his men to management, rather than that he is management's stooge. If a foreman can cause men to do the job as a co-ordinated and co-operative project, management will have gained much by delegating these added responsibilities to him.

In judging the quality of a foreman, one should judge the morale of the group he is leading. Any successful group gets things done, and a leader is in a key position to determine the degree of success.

EXPERIMENTS WITH AUTOCRATIC AND DEMOCRATIC LEADERS

Researches at the University of Iowa and by the Research Council of Boy Scouts of America show that authoritarian and democratic leaders have quite different effects on the group behavior of children.[7] When the leader took the group into confidence, permitted certain choices and looked for suggestions, the group became more constructive, co-operative, and interested than when he merely issued orders. Where democratic leadership was in constant practice, the group became more and more self-reliant, and discipline was maintained by social pressure. Interruptions and frustrations were less likely to destroy the co-operative effort and disrupt morale in democratically led groups than in autocratically led groups. Similarly, the democratically led groups were found to function more effectively in the absence of the leader than were groups led by autocrats.

The children in the autocratically led groups formed cliques or subgroups; deceptions and quarreling were frequent; lack of initiative and dependence on the leader were common.

[7] K. Lewin, R. Lippitt, and R. K. White, "Patterns of Aggressive Behavior in Experimentally Created Social Climates," *J. Soc. Psychol.*, 1939, *10*, 271–301; also R. Lippitt, "The Morale of Youth Groups," in *Civilian Morale*, chap. VII, pp. 119–142.

When autocratic leadership was considerate and friendly, it engendered better group spirit than when it was abrupt and disinterested. Previous experience with leaders was also a factor. Among children who had always experienced authoritarian rule, it was found less objectionable than among those who came from democratic backgrounds. Even in these cases, however, the leadership was most conducive to high morale when it was benevolent.

These experiments with children are indicative of what may be expected in a factory. If anything, the adult is more likely to oppose strictness and rigid discipline than is the child. It is also apparent that a change in the form of leadership must be introduced gradually or in stages, since individuals have to be guided into the new relationship. Where groups of men have been entirely irresponsible and wholly dependent upon a foreman for orders, they must learn to function in the new rôle.

That the results of the experiments with children are applicable to adults working in industry is actually being demonstrated at the present time. In order to remove all doubt as to the validity of the principles, the experiment has been carried into a factory, where the foremen are being trained to become democratic leaders.[8] The effects of the new type of training of foremen were almost immediate. It resulted in greatly improved morale and definite increases in production, which have been consistently maintained.

BASIC DISTINCTIONS BETWEEN AUTOCRACY, DEMOCRACY, AND LAISSEZ FAIRE

Popularly, democracy is regarded as a type of group control midway between autocratic discipline and individual freedom (laissez faire). It can readily be seen that, if all individuals were free to do as they pleased, a state of chaos would result in any situation where group effort was involved. Therefore, when we

[8] This work is being done by Alex Bavelas, who has kindly permitted the author to indicate the general nature of the experimental findings before their publication.

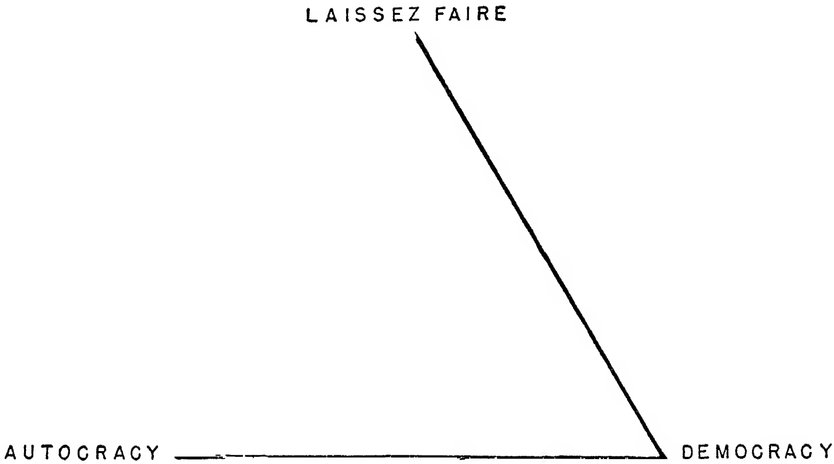

Figure 3. Relations Between Autocracy, Democracy, and Laissez Faire

This diagram shows that democracy is not the opposite of autocracy; rather, both are deviations from individual freedom or laissez-faire control. In group effort, complete individual freedom leads to chaos. Both autocracy and democracy limit freedom, but, in one case, the limitation is imposed on the group while, in the other, it is assumed by the group. (After Lewin, see footnote 9.)

regard democracy as a midway state of affairs, we are really thinking of it as a state between order and chaos. There is another way, however, in which the relationship between autocracy, democracy, and laissez faire may be viewed. Lewin, on the basis of experiments on these different types of group control, has been led to describe the relationship as a triangle (Figure 3), each type of control being a different pole and each having responsibility differently placed.[9] In autocracy, the responsibility resides in the leader; in democracy, it resides in the group; and in laissez-faire situations, it is distributed among the individuals as separate entities.

When perceived in this manner, the line between autocracy and democracy represents a continuum between complete leadership responsibility and complete group responsibility. Between these two extremes, we have conditions in which some responsibilities

[9] K. Lewin, "The Dynamics of Group Action," *Educ Leadership*, 1944, *1*, 195–200

are retained by the leadership, while others are attained by the group.

Both democracy and autocracy have lines leading to the laissez-faire condition, representing tendencies in the direction of complete freedom or chaos. There may be benevolent despots and paternalists who respect many individual freedoms, and there may be loose democracies which are controlled only in part by group action. Similarly, one may have strict despots and strict democracies. It is also apparent that a democracy may be more disciplined and strict than an autocracy. In the strict democracy, the group *will* dominates, and social pressure forces the individuals in line; whereas, in strict autocracies, the leader must exert control and wield the force. The leadership studies have shown that a democratically led group may become highly disciplined and efficient, a condition which leads to co-operation. Because the strict despot tends to create resentment, he is often forced to drift toward either one of the other two conditions in order to retain his power. The trend of experimental findings convinces Lewin that many democratic procedures are yet to be discovered and that the future of group action is to be found in these discoveries.

THE DEMOCRATIC LEADER IN INDUSTRY

Democratic leadership is achieved by learning to share one's responsibility with the group; by becoming sensitive to the group's thinking; and by acquiring skill in bringing about a meeting of minds. The technique of sharing responsibility is primarily one of asking the men to assist in solving problems with which they are concerned in the work situation. Employees have strong feelings regarding the handling of many situations, and when they participate in solving a problem, they not only see many sides to a question, but they become more constructive in their thinking.

Often the group suggests a solution that the leader originally

had in mind. Even these solutions are worth finding because they are more acceptable when they come from the group than when imposed by an authority.

One of the most difficult aspects of leadership training is to convince the leader that he strengthens his leadership and influence when he shares the solving of problems with his men. Leaders usually feel they are giving up something when they refrain from giving orders. Those who can be induced to try the method find they gain in influence. Because of prevailing doubt that the technique is feasible, an important factor in training is one of giving trainers the opportunity for practicing the procedure. As skill is gained, one finds he can go from relatively unimportant problems having to do with schedules and vacation dates to such important problems as determining the kind of service the public should receive from the company. When this problem is successfully presented, employees plan and give better public service than the company dare demand. Illustrations of specific problems solved by employees are found on pages 264 ff. and 402 f.

The technique of attaining a meeting of minds is one of finding a solution which best fits the group. The most popular solution may not be one that any one person suggested. A skilled leader functions to crystallize the thought and goes beyond the point of obtaining a mere majority opinion. However, when opinion is strongly divided, a majority may be the only solution, and even though some may dislike the solution, the leader escapes blame.

Democratic leadership quite naturally utilizes several principles associated with good morale. It is a technique for extending participation; sacrifices and benefits tend to be mutual because the leader is close to his group and learns the prevailing values; and freedom and tolerance thrive as authoritarianism and rules are withdrawn.

In addition to utilizing principles conducive to good morale, democratic control goes a step further and uses the group spirit for constructive purposes and achieves what a coach calls "team

spirit." Instead of confining his activities to purely favorable individual relations, the democratic leader attempts to develop a group spirit. He no longer controls from the outside, but becomes an integrating force from within.

Higher levels of management may fear that the foreman will go too far in giving men a say-so in deciding issues and solving problems. As long as a foreman shares only his authority, or practices the method within his area of freedom, he does not exceed his own position. Thus he may counsel with his men on how the work on a job should be distributed when this is his problem. However, he may not have them determine wage rates for a job when this issue falls beyond his jurisdiction. In a similar manner second-line supervisors may share their area of freedom with first-line supervisors, and in doing so become aware of the attitudes of first-line supervisors. If the method is practiced at all levels of supervision, communication from lower levels to higher levels is greatly facilitated.

Another fear in the use of democratic methods has to do with the wisdom of employees' decisions. One does not solve a mathematical problem by putting it to a vote. Some problems must be solved by experts, and many decisions require expert knowledge and judgment. A distinction, therefore, must be made between problems which hinge on differences in attitudes and tastes and problems which require factual knowledge. Often the foreman has the necessary factual knowledge and he then may function as an expert. Frequently, however, a foreman feels he must pose as an expert and in these cases he would gain if he functioned as a leader. Too often the expert forgets that human beings must like a new method in order to use it co-operatively, and when he imposes the new method on the group, he encourages a dislike for it. If the expert's approach is one of selling and advising, he is more likely to succeed than if he resorts to authority. Democratically led groups are not as suspicious of change as are groups dominated by autocrats. They listen to the expert if he listens to them.

FOREMANSHIP AND LEADERSHIP TRAINING

From the foregoing discussion, it is apparent that the foreman (or supervisor) who serves as a democratic leader must be of a higher type than the foreman who serves as an autocratic boss. Not only must he know the job, but he must also know how to handle men so that they will function in co-operative effort. To achieve the good will of a group requires more skill than to impose one's will on the group. For these reasons, selected individuals must be given special training in leadership. Foremanship training in the past has been largely confined to adjusting a man to his new rôle and extending his knowledge of the job.

The special training not only has the advantage of improving a foreman's skill in handling men, but has other advantages as well. In the first place, a program of training serves as a transition period in which the prospective foreman grows into his new rôle. Without such a period of adjustment, he may feel overimportant and become overbearing in his treatment of his men, because of the suddenly increased authority and responsibility. In the second place, although men are likely to be jealous if one from their own group is put over them, if the prospective foreman successfully passes through a period of training, they may realize that he has acquired knowledge which justifies his new position. This is particularly true if the selection method is based on high standards and if the training is difficult. Officer training in the Army serves to make adjustments of this kind. In the third place, the period of training offers an additional opportunity of choosing or selecting the best-qualified men. Management, therefore, secures another kind of record on which to base final choices. All men who are selected for officers' training in the army do not become officers. They must satisfactorily compete with others before they are commissioned. Since many have no desire for a change in status and do not apply for training, the volunteer method in itself permits some selection to be accomplished automatically, because

it eliminates persons who are not interested in responsibility and supervisory work.

The type of training given to selected applicants should involve the acquisition of knowledge such as is found in a book of this kind. After learning the application of psychological principles in general, the prospective foremen can be taught to study their men and to learn about their interests and home life. Illustrations should be used freely. For example, they can be shown how to introduce their men when visitors come to their departments. By referring to a man as one of the most skilled, the most dependable, the best-natured, or as having a son in college, they will make each man try to distinguish himself in some way. If a foreman really studies his men, he can find many things to say about them that will be sincere, as well as complimentary. The importance of incidental but thoughtful gestures should be emphasized throughout the training period.

In addition, the training should consist of practice in handling men. A man cannot play golf after reading books about it. He must get out on the golf course and acquire skill through practice. Practice under supervision has been found to be highly important in training leaders.[10] A man may not know when he is being sarcastic, unreasonable, or impatient. He may not know when he is talking over a man's head or frightening him. He must learn to become sensitive to the reactions of others. It is surprising how insensitive most people are to the way they affect other people. The most boring men often seem quite content to believe they are great entertainers. They are, therefore, unlikely to change their boring habits. By practice and criticism, the foreman can learn to detect his own weaknesses and become aware of the way his methods influence his men. In addition, he learns to take criticism and advice. Becoming sensitized to the reactions of the members of one's group is one of the most important benefits to be gained from leadership training.

[10] A. Bavelas, "Morale and the Training of Leaders," *Civilian Morale*, chap. VIII, pp. 143–165.

Experiments in training leaders how to handle groups of children have clearly demonstrated that a large number of men can benefit greatly from such training.[11] The author's own experience in supervisory training supports the conclusion that foremen can profit from leadership training and in some instances mediocre supervisors are transformed into outstanding ones. The improved skills in leadership show direct effects in improved group work and job satisfaction.

Leaders also learn much from discussion with other leaders. If supervisors meet and discuss their problems, they continue to improve and learn to see men's actions as problems to be solved rather than as headaches.

Because foremen and supervisors are teachers, as well as leaders, they must know their trade well and, in addition, have the ability to pass their knowledge along to others. Some training along these lines is also highly desirable. Helpful suggestions for the training of men in skills are given in Chapter 11.

If he is to maintain high morale among his workers, it is essential that the leader have high morale himself. His good spirits and enthusiasm will reflect themselves in the group he leads.

MEASURING GROUP UNITY

Harmony is found in groups in which the individuals are homogeneous in the sense that each has similar standing in the group. When the group is subdivided into cliques, conflicts arise and certain individuals become scapegoats. Such dissensions cause a disruption of harmony and create a condition of low morale.

SOCIOMETRY

An ingenious method of analyzing group status was developed by Moreno.[12] His technique is relatively simple, but very effec-

[11] Bavelas, A , *op. cit.*, pp. 149–155

[12] J. L. Moreno, *Who Shall Survive? A New Approach to the Problem of Human Interrelations* See also G. Murphy, L. B. Murphy, and T. M. Newcomb, *Experimental Social Psychology*, pp. 306–320.

tive. Members of a group are asked to vote on their preferences for one another. The voting is based on preferences in specific situations. For example, a department in a factory might be asked to vote on the following questions:

1. With whom would you prefer to work?
2. With whom would you like most to lunch?
3. Who would make a good foreman?

Each person is usually asked to list three preferences in answer to each of the questions.

Analysis of results from such questions reveals that certain individuals receive a large number of votes. Such individuals are designated as *stars*. Others receive few or no votes. These are designated as *isolates*. There are also those who invariably vote for one another. These are known as *mutual pairs*. Sometimes the voting takes the form of a *triangle*, in which A wants B, B wants C, and C wants A. It is apparent that this method would readily reveal the existence of small cliques in which the voting is confined to certain individuals, thus producing a frequent number of mutual choices and triangles.

The existence of any subgroupings would immediately become apparent upon the examination of the results. From a single test of this sort, more can often be learned than from careful observation over a long period of time. The results check with general observations, and they also reveal details and relationships which greatly augment those which may be discovered by an observer who is in constant contact with the group. The existence of isolates is of particular interest. Isolates are the unhappy and poorly adjusted individuals in the group. In school situations, they can be given special attention by the teacher. By placing responsibility upon them, she can force them into activity and thus help to improve their status in the group. In a factory, the foreman might single out the isolates for special attention and help them to make better adjustments to the group.

Stars usually take care of themselves. A knowledge of their existence, however, would serve as one of the bases for choosing men for foremanship training. They are the individuals who very probably possess the best personality traits for leadership, since there is good assurance that they will not antagonize people.

The teacher in a classroom plays an important part in determining the type of group structure which will emerge. The study of group structure thus becomes a method for evaluating teachers. In the same way, successful foremen might be distinguished from inferior foremen.

The data obtained by the Moreno technique may be graphically represented by a device known as a *sociogram*. Suppose that each member of a group is represented by a circle, and choices are indicated by lines drawn between the circles. Arrows can be used to indicate the direction of a choice. By using solid lines to indicate mutual choices and broken lines to designate one-way choices, we can differentiate between these two forms of preference. The number of votes received can be given in the center of each circle, together with the name or letter of the person. The sociogram in Figure 4 shows E to be a star, with eight votes; and J to be an isolate, with no votes. A, B, and D show definite preferences for each other, and, with the exception of each other, vote only for E. These three persons constitute a subgroup. If repeated sociograms revealed the same grouping, evidence of the permanence and strength of the clique would be apparent. Supplementary observation would reveal whether the subgroup was disruptive or was merely based upon external conditions, such as belonging to the same lodge. To simplify the picture, one would merely diagram the mutual choices and indicate in each circle the total number of choices received. The omission of the dotted lines in the graph would show more clearly the presence of clusters and isolates. The standing of each person in the group would be shown by the total number of votes he received.

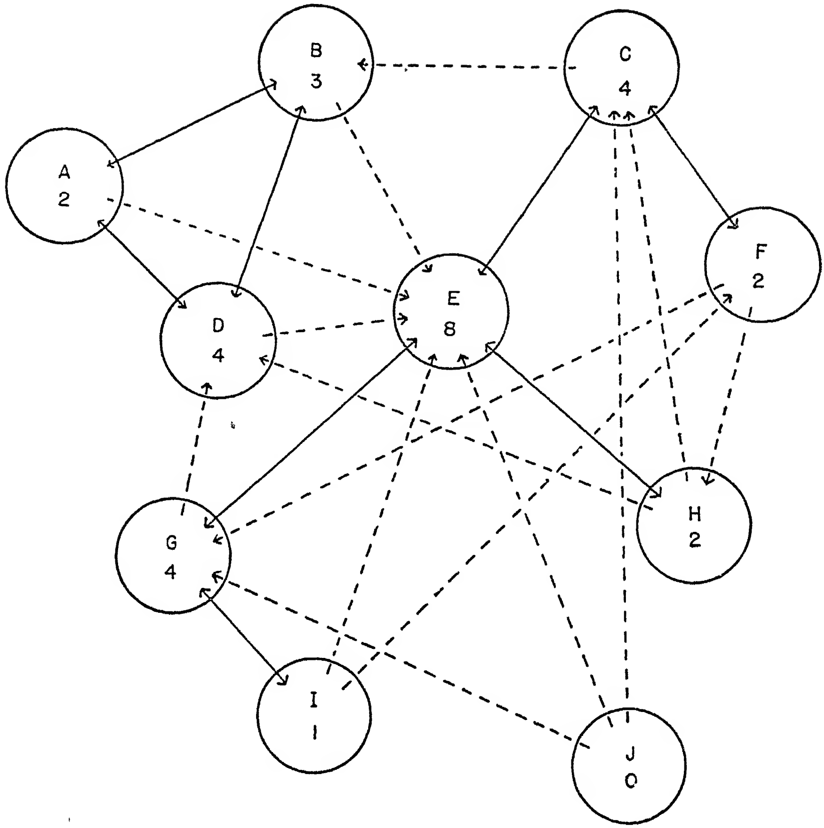

Figure 4. Sociogram of a Group of Ten Workmen

Each workman is represented by a circle, the letters of the alphabet being substituted for names. Each member of the group was asked to vote for the three men most desired as working companions. The numerals in the circles show the number of votes each man received. The arrows indicate the direction of the choices, whereas solid and broken lines designate mutual choices and one-way preferences, respectively. Individuals A, B, and D form a triangle, E is a star, and J is an isolate.

After an analysis of this sort, one could compare the sociographs of productive and unproductive groups. A foreman would then have a definite guide as to the type of group structure he should attempt to develop. By making sociograms at specified intervals, it would be possible also to learn the effects of certain company policies on the group behavior.

SOME IMPLICATIONS

Experimental studies have shown that sociograms readily reveal the existence of racial prejudice. As long as a minority group is small (10 per cent or less), the race line is not drawn. As Negroes approach the whites in number, the choices follow race lines to a greater and greater degree. There exist saturation points, and, to maintain group harmony, it is essential to stay within certain percentages. The harmony of dormitory life among students has been improved by recognizing facts of this nature.

The racial question is likely to reach the danger point in communities in which the number of Negroes is rapidly increasing. Segregation does not solve the problem, but merely avoids it. The solution suggested from sociometric studies seems to be one which permits the mixing of a small percentage of Negroes with the rest of the population. With a safe proportion of Negroes, the color line is not drawn; thus education and tolerance can proceed. It is significant that in the 1943 race riot in Detroit the troublesome areas were the blocks in which there was a boundary line which separated Negroes and whites. The mixed blocks were strikingly devoid of trouble and showed the benefits of education through contact.[13]

Psychometric studies have also been made on the influence of sex in group organization. In public schools, children in the fourth and fifth grades do not choose across sex lines. By the seventh and eighth grades, however, the barrier ceases to be very marked. Whether or not women in industry will constitute a source of friction remains to be seen. It is quite likely that they will become a greater problem as they increase in number, and work side by side with men on the same jobs. Certainly, a period of education would help to prevent friction and jealousy. Too large a proportion of women is likely to precipitate the drawing of a sex line in industry. When this occurs, any disagreeable ex-

[13] A. Bichman, "Detroit Race Tension Still High Despite Army Rule," the newspaper *PM*, June 25, 1943, p. 4.

perience with a woman worker will be interpreted as a sex, rather than as a personality, characteristic. Sociometric studies certainly would reveal the development of a sex line before it reached unpleasant proportions. The sharp drawing of such a line would delay the emancipation of women and would hinder the future of industrial development.

The method of sociometry may also be extended to express votes for dislikes. Preference votes do not distinguish between isolates who are neglected or unnoticed and isolates who are actively disliked. By negative votes, these two types of isolates can be distinguished from one another. Individuals who are neglected can more readily be brought into a group than can those who are actively disliked.

A sociogram may also serve a therapeutic function. If individuals are told of their status in the group, they may become responsive to their social obligations and become sensitive to human reactions. It would be very revealing and instructive to most people if they could know how they were accepted by others and if they could be informed of their position in this group by means of an objective diagram.

Experiments on institutionalized children have shown that girls have better morale when they are placed with house mothers with whom they have a mutual preference. By this method of placement, the girls meet several house mothers, and they, as well as the house mothers, vote on their preferences. In many factories a similar procedure could be followed in placing men with their foreman or supervisor. This procedure would avoid many unfortunate placements and future sources of trouble. An unfortunate first impression may remain for a long time. Because people tend to find in a man the qualities for which they look, the future conduct of a man tends to be interpreted in the light of the first impression he made. It is probable that this is the reason why so many people consider themselves good judges of human nature. If succeeding observations of a person are influenced by the first

impression, all the observations tend to be consistent. Once a person gives the impression of being sarcastic, this characteristic can be read into whatever he says and does. Thus, his later actions cannot help but confirm the first impression, and its unreliability is not discovered. Objective experiments have repeatedly demonstrated that one cannot judge human nature by such casual observations, but the impression that one can do it tends to prevail.

SOCIOMETRY AND INDUSTRY

To the author's knowledge, sociometry has not been applied to industry. Many practical men, therefore, will insist that the factory environment is unique and that theories based upon investigations with children and college students have no bearing on the behavior of the workingman. This criticism has also been leveled against the industrial application of laboratory data on attitudes and leadership training, yet in these cases the results have been shown to be applicable to the factory scene. Human nature does not change in basic ways when people grow up or when they leave college. The Hawthorne Study (page 33 ff.) clearly demonstrated that the factory is a social atmosphere; this would indicate that sociological techniques can be carried into the factory. The psychological satisfactions brought out in the morale study (page 83 f.) show that factory workers feel the need of personal recognition as much as do children, and that they are directly dependent upon their superiors for the attainment of these satisfactions. For managers to insist that factory workers are hard-boiled and materialistic, and for them to say that they know this to be the case through experience, indicates to the author that such managers have been dealing primarily with unco-operative employees. Their own experiences may have misled them because their contacts probably have been limited to an autocratic environment, and they fail to realize that a factory environment can be democratic, as well as autocratic.

Obviously, one cannot apply sociometric methods in a situation which is devoid of mutual trust and confidence. Suspicion and antagonism, when present, are not characteristics of factory employees; rather, they are their responses to a situation. Before new procedures and principles are introduced into a plant, the situation must be carefully surveyed so that misunderstandings will not arise. New applications, if made on a limited scale, can be expanded as satisfactory results appear and as techniques in preparing for their application are developed.

New discoveries in science must be harnessed properly before they are of value to industry. Just as engineers often mediate between the physical sciences and industry, the social and industrial psychologists may be of value in applying behavior theory to personnel work. A company which is on the alert for the utilization of new principles and concepts can do pioneer work in the management of manpower. The methods of sociometry allow the individual to state his needs and interests, as well as permit him to participate in the development of the social structure which is formed within the factory. Since the measurements obtained reflect the attitudes and values that prevail in the group, the human relationships found are realistic rather than artificially imposed from above. The utilization of such data makes it possible to capitalize on trends which are normally present and more readily permits the extension of democracy to the factory.[14]

[14] H. H. Jennings, "Sociometry and Democracy Unlimited," *Sociometry*, 1943, *6*, 293–298.

6 INDIVIDUAL DIFFERENCES

INTRODUCTION

It is commonly recognized that people differ from one another. This fact is especially apparent from their physical appearance. That differences are likewise present in the abilities of man will also be readily conceded. The full importance and the nature of the variation between people, however, is not generally appreciated. Many believe that practice makes perfect; yet no amount of practice on the part of one man will make him as proficient in his work as a little practice will make another. We also hear people classified as bright or dull, good or poor workers, easy-going or hot-tempered. The implication in each of these pairs of characteristics is that a man falls into either one of two categories.

In industry, it is common practice to pay men by the hour. This implies that a man's time is what counts rather than how much he accomplishes. Paying for time spent encourages men to put in their time rather than to produce according to their abilities. If a man falls below a certain level of performance, he may be discharged, but frequently the discharge is based upon factors unrelated to production. The fact that one man may be capable of producing as much as two or more other men, and requires no more equipment than each of them, is not sufficiently appreciated by the average employer.

Since marked differences in ability do occur, it can readily be

seen that proper selection alone would greatly increase production. Once the most capable available men are selected, pains can be taken to keep them, and to utilize their superior ability. Because superior individuals can do quite satisfactory work without much effort, they ordinarily need not exert themselves to keep their jobs. To get them to improve requires that inducements be offered to encourage them to produce in accordance with their ability. This is not a simple problem, since their associates may object to having their own deficiencies exposed. The objection on the part of less capable men to superior production is based largely upon the fact or impression that they will suffer thereby. It has been the experience of labor that, when men are paid for the amount they produce, some men have made a lot of money. When this occurred, they often found that management lowered the piece rate. This practice on the part of management became a cause of labor's objection to superior performance. If the employer wishes to utilize individual differences, he must do it in such a manner as to avoid opposition from labor in general. Although the improper utilization of man's ability may provoke opposition, it does not follow that differences in ability should not be recognized and utilized.

THE NATURE OF INDIVIDUAL DIFFERENCES

If we subject any aspect of man to measurement, we find that the measured trait is distributed in the population in a particular fashion. Further, all traits are distributed in a very similar manner whenever the traits are measured in individuals who are selected at random; that is, so that they are representative of the general population. The measured trait may be height, strength of hand grip, intelligence, ability to memorize, speed of reacting to a signal, honesty, or emotional stability. Regardless of whether one measures physical characteristics, mental traits, personality traits, sensory capacities, or muscular co-ordination,

the manner in which each is distributed in the population follows the same kind of pattern.

Suppose we have measures of a certain ability in a large group of people. Suppose we now arrange the people in lines, putting all those with the same scores into the same line. If these lines of people are now arranged side by side, with the low-scoring lines on the left and the high-scoring lines on the right, the various lengths of the lines would form an arrangement like that shown in Figure 5. This diagram shows the way 3184 children line up when they are arranged according to their intelligence quotients. If some other trait had been measured, the same individuals would not be in the same lines, but the arrangement of the lines would have followed the same pattern.

It will be seen that half of the population makes scores in the middle range (Figure 5). These are the average or near-average individuals. Scores above and below the middle range occur less and less frequently so that the lines become progressively shorter as we approach the two extremes.

We may represent the same thing by drawing a smooth curve, as in Figure 6. Here, the height of the curve represents the frequency with which the various scores plotted on the base line occur in a population. This is the theoretical normal distribution curve for individual differences. It is characterized by being symmetrical about a center, which is the average or mean.

The shaded portion includes fifty per cent of the total population. Mathematical procedures are available for marking off such parts of a curve, and these become landmarks for locating an individual's score in the distribution. The population represented in the curve in Figure 6 is thus divided into four equal parts. We can, therefore, refer to individuals as being in the first, second, third, or fourth quarter of the population in regard to the particular trait measured. It will be seen that the greatest variation in individual ability occurs within the first and fourth quarters. In the two middle quarters, the individuals are more closely bunched and are more homogeneous.

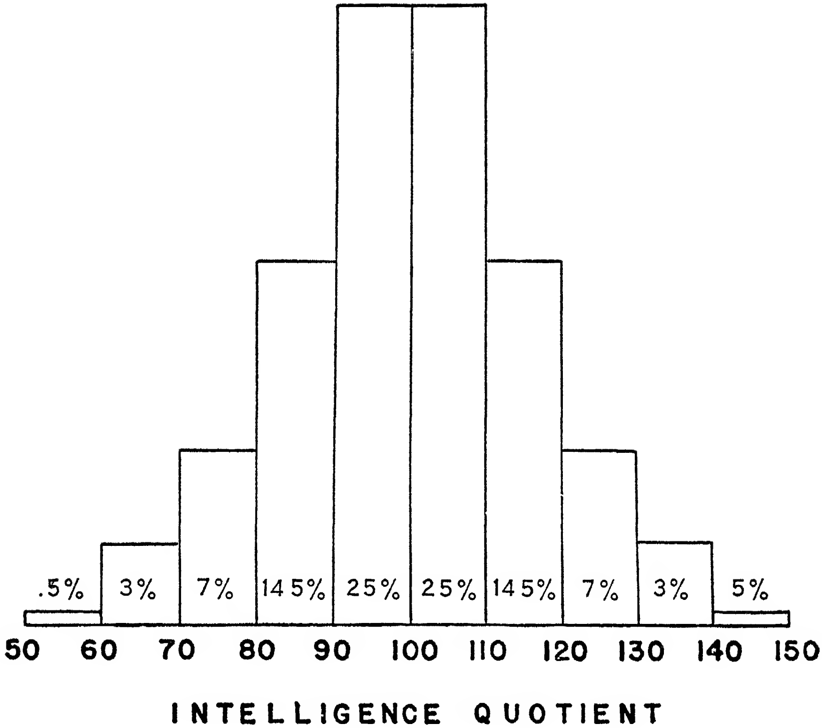

Figure 5. Distribution of Intelligence in 3184 Children

The height of the columns over each of the scores on the base line indicates the number of children making a given score. (After Guilford, J. P., "General Psychology," New York: D. Van Nostrand Co., 1939, 506; based on data from Terman, L. M., M. A. Merrill, "Measuring Human Intelligence," Boston: Houghton Mifflin Co., 1937.

When sufficiently large numbers of people are tested, when these are selected at random, and when the test is not too easy or too hard, the plot of the actual measurements obtained corresponds to the theoretical curve. Since tests which are too easy do not differentiate between superior individuals, scores tend to cluster at the upper extreme when such tests are used. On the other hand, tests which are too difficult cause a large number of failures, causing scores to cluster at the lower end. Such tests do not differentiate among the people who make low scores.

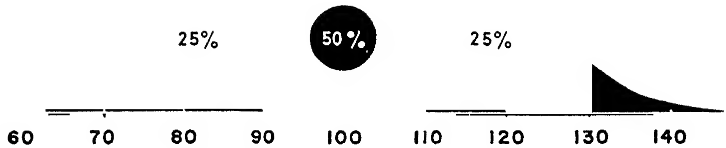

Figure 6. Normal Distribution Curve

The height of the curve indicates the frequency with which the various scores shown on the base line appear in population. Half of the people make scores which fall in a narrow band in the middle. The other two quarters make scores which are spread over a wider range, both above and below the middle band. If the middle half is divided into two quarters, the population is thereby divided into four groups of equal size.

The importance of any individual's score must always be judged by its position in the distribution curve. This position gives an idea of how rarely or how commonly his degree of ability occurs. The fact that a man can inspect two hundred parts in an hour has little meaning, but the fact that only three per cent of the men can do better than that shows clearly that he is very superior. To find another who would do as well would not be easy. Human ability, for the psychologist, is always a relative matter. To appreciate any one individual, we must know how he compares with the population as a whole.

VARIATIONS IN NORMAL DISTRIBUTIONS OF HUMAN ABILITIES

THE RANGE OF ABILITY IN DIFFERENT OCCUPATIONS

Although the abilities of an unselected group of people tend to be distributed as in the normal distribution curve, some varia-

tions do occur. These are variations in the spread of the scores. For some abilities, the highest score may be only one and one-half times as great as the lowest score; for others, the highest score may be twenty-six times as great as the lowest. A large variation may occur even when individuals with similar training are compared. In comparing scores of eighth-grade children, for instance, it was found that the ratio of the poorest to the best score was 1 to 1.5 for writing; 1 to 15 for arithmetic (addition); and 1 to 26 for history.[1] Such variations in measures of different abilities merely spread the distribution curve over a broad or narrow base line; they do not alter the fact that the central tendency occurs or that the curve is symmetrical about the middle point.

Figure 7 illustrates how ability to produce may be distributed

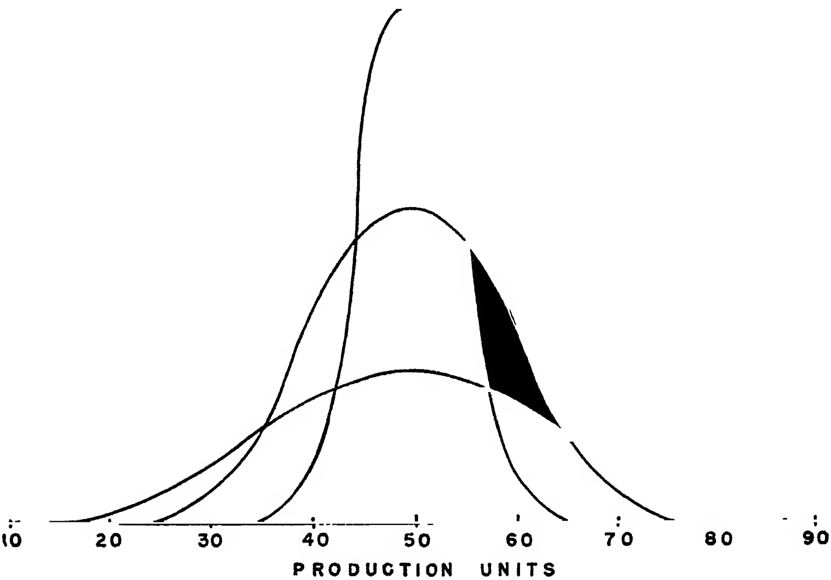

Figure 7. Three Normal Distribution Curves

Normal distribution curves may differ in the extent to which the ability measured is spread. The tall curve shows that the range from lowest to highest score is less than the ratio of 1 to 2; the flat curve indicates a range in score of more than 1 to 4. In simple occupations there is less of a spread in ability than in complex occupations.

[1] C. L. Hull, *Aptitude Testing*, p. 33.

in three different occupations. Usually, the actual accomplishments in gainful occupations do not have as wide a range as occurs in the general population. Greatly inferior workers are eliminated, and the incentive for the superior workers is not great. Nevertheless, the productive performances of different men are not as much alike as is usually supposed. For example, it has been found that for polishing spoons the ratio is 1 to 5, and that for loom operation it is 1 to 2.[2] In looping hosiery, the production of 199 employees ranged from three pairs to eighty-four pairs per hour.[3] These production figures, however, included those of inexperienced individuals. When the output of fully experienced persons only was studied, the range was still from thirty to eighty-four pairs per hour. These differences in production among hosiery workers showed very little fluctuation. Week after week, the same operators appeared at the head of the list, so that, on the basis of one week's record, one could accurately predict the position in the distribution curve which any given operator would occupy on the following week.

Generally speaking, the spread of a distribution curve is greater for complex than for simple abilities. When the range is great, it is particularly important to encourage the superior individuals to remain with the company, since their ability is an important factor in total production. The inferior workers either should be transferred to a more simple type of operation where the distribution is less widely spread and where varying degrees of ability show minor differences in production, or be placed in occupations which are very different from the one in which they are at a disadvantage. In a different job, the inferior individuals may fall in a more favorable part of the distribution curve.

DIFFERENCES IN EXPERIENCE CONFUSE THE PICTURE OF INDIVIDUAL DIFFERENCES

Practice does not tend to equalize productive ability. Differ-

[2] Hull, *op. cit.*, p 35. [3] J. Tiffin, *Industrial Psychology*, pp. 3–8.

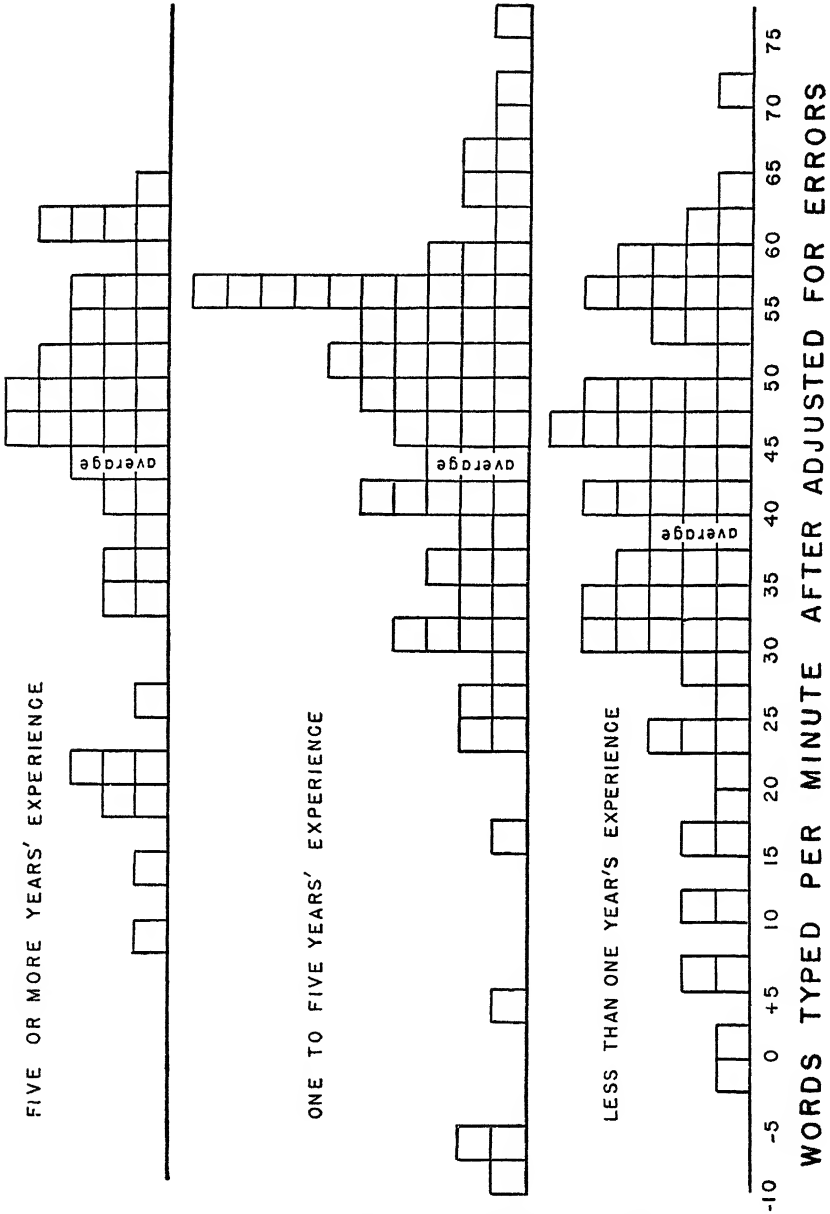

Figure 8. Range in Skill of Three Groups of Typists

The typists are classified according to length of experience. It will be seen that the variation of ability within each group far exceeds the difference in skill which accompanies experience. The average ability is lowest in the group with less than one year of experience, but for the other two groups which have from one to five years of experience, the averages are equal. (After Paterson and Darley, p. 94.)

ences in ability to learn a task may actually increase the range. Great emphasis on the number of years of experience as a qualification for a job is a mistake. That length of experience is not a satisfactory basis for choosing employees is shown in Figure 8.[4] Applicants for stenographic positions were divided into three groups: (1) those with five or more years' experience; (2) those with one to five years' experience; and (3) those with less than one year's experience. The figure shows that, when the experience was matched, a wide range in ability still occurred. The average ability for each group is indicated by an arrow. Although the more experienced stenographers had a slightly higher average, the difference in no way made up for the wide variation in ability between individuals.

Since each person has an inborn capacity for learning to do certain kinds of work better than others, attempts should be made to train him on jobs that best suit his natural talents. Experience can develop the potentialities, but how much it will develop them is dependent upon the original endowment. In comparing human performances, it is well to match experience in order to bring out the original differences in ability because these differences give an indication of future performance. For instance, suppose one individual can do exactly as much as another, but does so with a lesser degree of experience. In such a case, we can expect the former to surpass the latter when both have added the same amount of experience. It is therefore wiser to employ the man with less rather than the one with more experience. For many industrial purposes, individual differences in ability are far more important than varying degrees of experience.

DEVIATIONS FROM NORMAL DISTRIBUTIONS

Although the measurement of a given trait may be adequate for testing both extremes of ability, a normal distribution curve is not always obtained. When this occurs, we know either that

[4] D G. Paterson, and J. G. Darley, *Men, Women and Jobs*, p. 94.

we are dealing with a special group of people or that some factor is operating to influence our measurement of ability.

BIMODAL DISTRIBUTION CURVES

If one measured the strength of hand grip in a mixed group of men and women, the distribution curve would have two high points. Normal distribution curves are obtained from either men or women, but the curve for women would be shifted somewhat to the lower end. The two humps obtained from the measurements of the combined group represent the averages for the two sexes. An example of a bimodal curve of this nature is shown in Figure 9.

Such curves reveal that we have actually measured a combination of two different populations. Similar curves would be obtained if we measured the intelligence of a group of college students combined with a group of subnormal people. If two extremely different groups were combined in this manner, the distribution would result in two entirely separated curves. The bimodal effect is due to incomplete separation.

In certain departments of industry (see pages 392–395), one obtains a bimodal distribution curve for intelligence when persons of average ability are discouraged and tend to find jobs elsewhere.

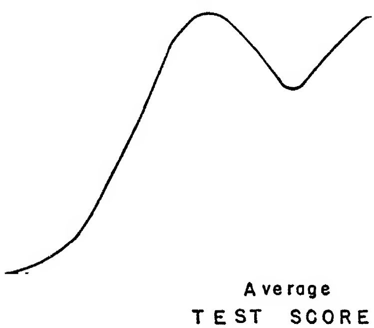

Figure 9. Bi-modal Distribution curve

Curves of this type are obtained when two different populations are combined or when a selective factor, which eliminates persons of average ability, is operating in a single population.

This occurs when men of superior intelligence are given more desirable work. The inferior ones are content to remain, but the average employees in the department are not satisfied with their positions and so tend to seek other work. The remaining workers cease to be representative of the industrial population as a whole, since a selective factor has operated to eliminate persons with a specific degree of intelligence. If it is found that the individuals of below-average intelligence are doing satisfactory work, this selective factor is desirable. The intelligence test can then be used for selecting individuals having the desired degree of mental ability.

A bimodal curve, therefore, indicates the presence of a separation in a population. This is not a usual or common condition, however, and, when it occurs, the reason for its presence should be sought. That it occurs only under special conditions emphasizes the point that people cannot be divided into categories or classified into types. If people either are honest or dishonest, wise or foolish, good or poor workmen, bimodal curves would be the rule rather than the exception.

SKEWED DISTRIBUTION CURVES

A selective factor also operates when people of either superior or inferior ability tend to leave a job. In such cases the distribution curve is no longer symmetrical and is spoken of as skewed toward the upper or lower end.

In skewed curves, the most frequently occurring scores fall to the right or the left of the middle point. The average thus ceases to be the middle score. Labor which has been well selected should have a relatively low concentration of men with inferior ability. A curve showing the production of a highly select group of workers would, as a consequence, be skewed toward the upper end. Hiring through interviews and recommendations alone cannot accomplish this kind of selectivity as accurately as objective tests. Since appropriate selection of labor is revealed by the dis-

tribution curve, one can test the efficiency of the employment division of a plant and determine how well it serves the selective function.

In school populations, a selective factor operates which discourages students with lesser intelligence. How this selective factor alters the specific populations is shown in Figure 10. At higher educational levels, there is a progressive weeding-out of individuals of relatively lower intelligence so that the population becomes more and more select. Note how the curves become less and less symmetrical as one goes from grade-school to college populations.

Select populations are highly desirable in industry, since they tend to be more homogeneous and specifically adapted to do a particular kind of work. The best vocational guidance would be that which placed each individual in the kind of work which gave him his most favorable position in the distribution curve. This kind of guidance would actually fit the man to the job.

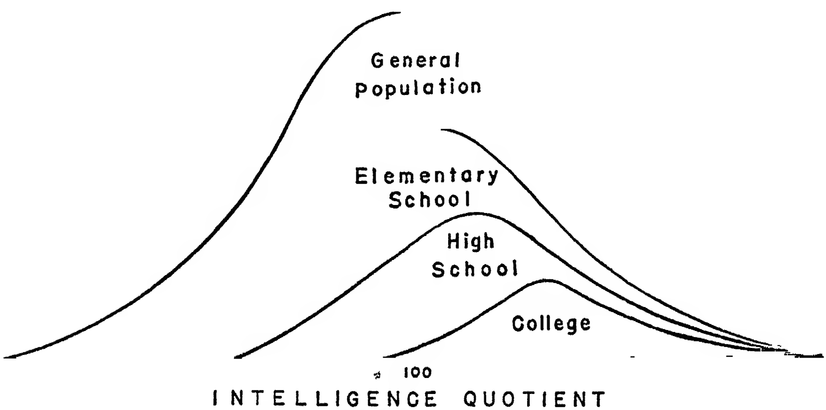

Figure 10. The Selective Process in School Groups

In progressive levels of education, the lower levels of intelligence gradually drop out so that a college group contains very few individuals below average in intelligence. The curves become more and more asymmetrical as greater numbers are eliminated from the lower levels than from the higher levels of intelligence. A selective process which eliminates a greater proportion of individuals from one end of the distribution curve than from the other gives rise to a skewed distribution. (After Hunt, T., "Measurement in Psychology," New York· Prentice-Hall Co., 1937, p. 94.)

Since a man is most contented when he is doing work which he can perform fairly proficiently, this procedure would not only increase the productive capacity of a company, but it would increase work satisfaction as well.

CURVES OF RESTRICTED PRODUCTION

Another type of curve is frequently found when actual production in a factory, rather than ability to produce under carefully controlled conditions, is measured. A theoretical distribution curve of this type is shown in Figure 11. This curve shows that

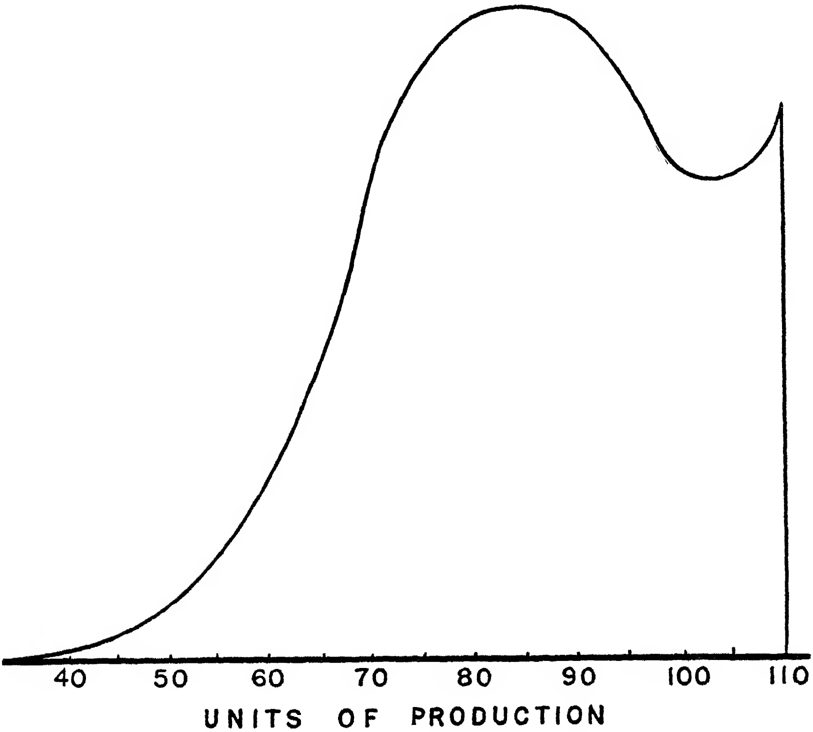

Figure 11. Curve of Restricted Production

This curve is cut off sharply because individuals who have the ability to produce the greatest amounts limit their production to 110 units or less The result of this restriction in production is that a large number of individuals produce a maximum amount. Since abilities are not distributed in this manner, the maximum production in this case indicates an artificial value rather than the limit of ability.

the expected superior producers are conspicuous by their absence. The curve is sharply cut off because the superior individuals are producing a lesser amount than their ability warrants. Instead of being at the extreme right, these cases form a cluster which is indicated by the sharp rise at the right end of the curve. Apparently, there exists among the men an agreement not to produce more than a certain number of units. It is at this amount of production that the curve is sharply cut off. Thus, the production record does not give a normal distribution curve because the superior workers are not exerting themselves to the same degree as the others.

This condition, known as *restricted production*, sometimes arises when there is a fear of rate cuts. Social pressure forces the superior individuals to abide by the wishes of the majority. Previous experience with rate changes and rumor usually are the basis of this fear.[5]

MEASURING THE RELATIONSHIP BETWEEN HUMAN ABILITIES

INTRODUCTION

In discussions of human abilities, it is frequently desirable to know the relationship between them. For example, it is known that success in college is related to intelligence. Since this is known, we may predict with reasonable accuracy that a person with high intelligence will succeed in obtaining good grades in college. On the one hand, the knowledge of such a relationship will aid in the selection of students by excluding all those who fall below a certain intelligence level. On the other hand, it serves a diagnostic purpose. If a student of high intelligence does very badly, we can seek other reasons to determine the nature of his difficulty. How much we expect of a student depends largely on a knowledge of such relationships.

In industry, we are interested in ability to produce. For this reason, it is desirable to learn whether certain specific abilities are

[5] C. S. Myers, *Mind and Work*, pp. 111–131.

related to competence in a given job. If marked relationships are found, and the specific abilities are subjected to measurement, we can select superior individuals on the basis of such tests. The degree to which the tests are selective will be indicated by the magnitude of the relationships existing between the test scores and job performance.

Successes in various jobs may also show relationships with one another. If these are known, they may aid in shifting men from one job to another when conditions demand. Even a man's interests may be related to success. Generally speaking, a man tends to have more ability in tasks for which he has special interests than in tasks for which interest is lacking. Interests in certain activities may also be related to ability in quite different areas. For example, interest in playing football, in wrestling, or in other sports involving physical contact is related to success in piloting a plane under combat conditions. These instances suffice to show how a knowledge of relationships between abilities has practical implications for industry.

CORRELATION COEFFICIENTS

To demonstrate the presence of a relationship between two sets of measurements, we may plot one against the other. A hypothetical graph or scattergram of this nature is shown in Figure 12 *a*. Each dot represents an individual. The production score for each individual can be read by noting his position above the horizontal axis, while the test score can be found by reading its value from the vertical axis. This type of *scatter diagram* can be made whenever we have two sets of measurements on the same group of individuals.

If a perfect relationship exists between two sets of scores, the dots arrange themselves in the straight line shown in Figure 12 *b*. When a linear relationship of this type exists, a scientific law can be formulated, and prediction is perfect. Such a relationship exists between the length of a column of mercury and the tem-

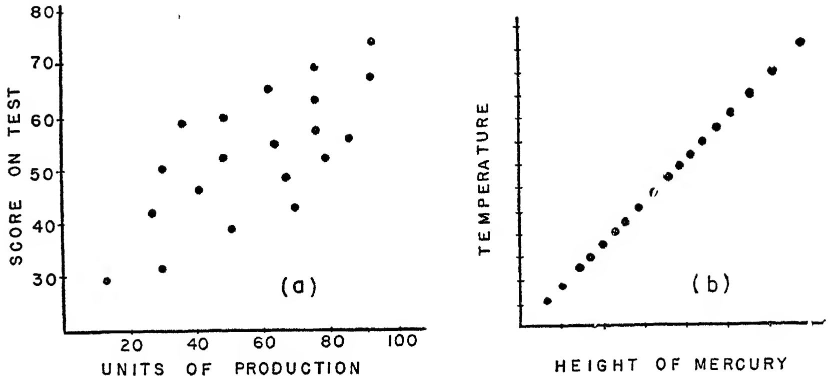

Figure 12. Correlations Coefficients

(a) Relationship between test score and production. Each dot represents an individual, whereas the position of the dot indicates the production and test score of the individual. The arrangement of the dots shows whether or not there exists a relationship between test score and production. (b) Relationship between temperature and length of a column of mercury. In this case, the dots represent different times at which the two measurements are made. When the dots arrange themselves in a straight line, the relationship between the two variables is perfect.

perature. If we had a chart for measures of this kind, we could determine the temperature by reading the length of the column of mercury.

Another straight-line relationship occurs when the dots arrange themselves at right angles to the line in Figure 12 *b*. In this case, the highest score on one test would go with the lowest score on the other test, the second highest with the second lowest, and so on. This arrangement of dots would express an inverse relationship, such as is found between the volume of a gas and pressure.

When the relationships are less than perfect, the dots merely tend to fall about a straight line. The distribution of dots then seems to fall within an elliptical area, as in Figure 12 *a*. If the long axis of the ellipse is in one direction, the relationship is positive; if in the other direction, it is negative. The more extreme elliptical arrangements indicate high relationships. The most extreme relationship occurs when the short diameter of the ellipse is zero, and such an ellipse becomes a straight line. If no

relationship exists between two tests, the dots do not tend to group about an axis. The scatter of dots thus appears circular rather than elliptical.

From inspection of scatter diagrams, we can see whether or not relationships exist, whether they are small or large, and in what direction the measures are related. By means of statistical formulae, we can express the degree of relationship by a value known as the *correlation coefficient.* When a perfect relationship is found, the value of the coefficient is 1, and when no relationship exists, the value is 0. Values between 0 and 1, such as .2, .5, .8, indicate varying degrees of relationship. Since relationships may be positive (direct) or negative (inverse), the correlation coefficients are given a plus or minus sign so that the correlation values range from -1 to $+1$.

When dealing with the relation between human traits or abilities, perfect relationships are never obtained. For example, relationships exist between height and body weight, intelligence and school grades, performance on certain tests and ability on a job, but none of these relationships are perfect. Relationships between $+.5$ and $+.7$, however, are frequently obtained in studies of human traits or abilities. This is the extent to which body weight and height are related. It is quite obvious that, if men were divided into two groups on the basis of body weight, one group would have an average height definitely exceeding that of the other. Individual exceptions would occur, but, as long as the relationship existed, we could do better than chance if we utilized a measure of one trait to predict a measure of the other. The number of exceptions increases as the correlation coefficient decreases, and the number decreases as the relationship approaches a correlation coefficient of 1.

INDUSTRIAL APPLICATIONS OF CORRELATED PERFORMANCES

Any industrial tests will be worth using which correlate .3 or better with performance on a job, and such tests will be superior

in predictive value to non-psychological procedures, such as the use of photographs and general impressions. A combination of tests, each of which measured something different and all of which correlated with job performance, would greatly increase the accuracy of prediction. Correlation coefficients of .6 or better are highly important, and any test which correlates with job performance to this degree is about as good as can be expected. A little study of a scatter diagram of test scores plotted against job performance (such as shown in Figure 12) readily shows how the exclusion of individuals with test scores below a certain level would eliminate a large percentage of poor performers on a job.

Another useful application of the scatter diagram arises in situations where it is desirable to shift men from one job to another. Suppose one had a knowledge of the correlation of performance on various pairs of jobs in an industry. If more men were needed on some jobs and could be spared from others, one could shift men between correlated jobs and expect them to occupy similar positions in the distribution curves. Thus, if job *A* correlated with job *B*, it would be safe to transfer men from the *A* to the *B* job with a good probability that the transferred men would be about equally successful on the new job as they were on the old.

When men do poorly on one job, it is advisable to shift them to jobs which are uncorrelated or negatively correlated. In two jobs which are uncorrelated, it is reasonable to expect a person's performance on the one to be different from that on the other. If, therefore, a person does very badly on one job, it is probable that he will not do so badly on the other. When a negative correlation exists, one may actually expect the person to be in a superior part of the distribution curve after the change.

In recent years, psychologists have constructed lists of jobs which they speak of as *job families*. A job family consists of occupations which demand similar patterns of activity.[6] Through

[6] C. L. Shartle, B. J. Dvorak, and associates, "Occupational Analysis Activities in the War Manpower Commission," *Psychol. Bull.*, 1943, *40*, 701–713.

job analysis the relative importance of each activity is determined and consideration is given to the time that would be saved in training, if transfers were made from one job to another. Jobs which require (1) similar activities, (2) the same worker characteristics or traits, (3) corresponding machines, tools, and instruments, and (4) work on the same kinds of material (for example, wood) are placed in the same family. As many as eighty-five job families have been prepared at the present time. When shifts in workers become necessary, manpower is efficiently utilized if the transfers are made within the job family. The correlation of performance on jobs within the job family serves as a check on the degree of relatedness in each family. Future work along these lines may become a great aid in vocational training as well as in the re-education of displaced workers.

The correlation procedures are used in all cases in which it is desirable to obtain measures of the interrelation between various abilities or of the relationship between different kinds of tests and job performance. Experience with tests has shown that ability relationships are not as obvious and simple as is commonly believed. Mathematical procedures are essential tools for all job analyses and selection methods and therefore are highly important to the industrial psychologist. His work, however, is highly technical and does not fall within the duties of the average supervisor or manager. An appreciation of the rôle of the psychologist in industry and an understanding of the complexity of the abilities of man, however, are important to the supervisor, and it is hoped that the above discussion will prove to be enlightening to the supervisor in these respects. The treatment of individual differences will have achieved its purpose if it (1) reduces the tendency of the reader to judge the abilities of others in the light of his own abilities, (2) encourages him to look for special talents in his men, (3) stimulates him to make comparisons in terms of relative abilities, and (4) makes him analyze jobs and duties in terms of human abilities. An understanding attitude toward individual differences

on the part of the supervisor will be recognized by subordinates, since such an attitude leads to the kind of personal attention to which employees have referred in the morale studies (see pages 83–84).

ABILITY AND PERFORMANCE

What a man can do and what he actually does are not necessarily the same. The term *ability* refers to a person's potential performance, whereas the term *performance* refers to what a person actually does under given conditions. How a man performs on a job depends both upon his ability and his willingness or motivation. We may express the relationship between these factors by the following formula:

$$\text{Performance} = \text{Ability} \times \text{Motivation}$$

According to this formula, performance has a value of zero if either ability or motivation is absent, and increases as either factor rises in value.

In order to measure a person's ability, it is necessary to get him to perform. As long as motivation is the same for all individuals in a group, variations in their performance records reflect differences in ability. Ordinarily, test situations are conducive to uniformly good motivation, so that test performance scores become measures of ability. Psychological test scores are regarded as measurements of ability because of this assumed constant in motivation. When there is reason for believing that the motivating conditions have been disturbed, the test scores have little meaning.

A job situation, however, does not induce similar motivation in all employees. When the performance of an individual is poor, it may be either because of his lack in ability (due to low aptitude or insufficient training) or because of his poor motivation. The performance record itself does not give the clue to the cause of the poor performance.

It might be supposed that the refusal to perform to the full extent of one's ability is the same, in effect, as the possession of a lesser degree of ability. Such a supposition, however, may lead to grave errors. It is true that an army which has the ability to fight, but lacks the *will* to fight, may lose the battle to an army which has less ability and more *will*. However, the first army may be transformed into one which *wills* to fight; but this must be accomplished by different procedures from those involved in transforming the second army into one of greater ability. It is necessary to distinguish between ability and performance, because the remedies for deficiencies in these two factors are very different.

To get a man to do his best is a problem in motivation. This subject will be treated in detail in chapters 12 and 13. A man's ability to do a job, however, is a matter of training and natural capacity. It is these factors which we attempt to measure in tests of human ability.

Obviously, measures of production in a plant reflect both ability and the *will* to produce. Motivation and morale supply the will (to some degree, they may also influence ability), and hence play an important part. No amount of motivation, however, can entirely make up for lack of ability. To get the whole story, one must appreciate the contributions of both ability and motivation to performance on a job.

The range in individual differences in production usually is narrower than the range in ability to produce. If all men exerted themselves to the same degree, such a difference between production and ability would not occur. Under most working conditions, the men of inferior ability tend to exert themselves to a relatively greater degree than do the superior individuals. The result of different degrees of motivation on men with varying amounts of ability is to bring their actual performances closer together. This narrows the range of the individual differences in production. It might be supposed that such a condition is desirable, since it

shows that effort or willingness can compensate for lesser ability. However, in making this interpretation, we lose sight of the fact that the superior individuals are the ones who are not sufficiently motivated. It is the superior individuals who are important for efficiency, and any condition which does not utilize their potential ability is inefficient. Narrowing the range in individual differences should be achieved by proper selection, not by discouraging superior individuals.

7 MEASURING PROFICIENCY

INTRODUCTION

The recognition of differences in the abilities of men immediately suggests the desirability of measuring the amount of work that men do on a job. Such measurements would not only bring to light the existing differences in ability, but would serve other purposes as well. They would make it possible to differentiate between superior and inferior workers and thus permit an analysis of their respective abilities. By measuring the characteristics of workers differing in productive capacity, it would be possible to determine whether certain traits are present to a different degree in efficient and inefficient workers. These traits or characteristics might have to do with personality, intelligence, muscular coordination, sensory capacity, or bodily structure. A knowledge of the desirable characteristics would be very helpful in selection and placement of workers.

In measuring proficiency in work, one must distinguish between merit and production. Merit is a far more general aspect of proficiency than production, since it includes productivity on the job as well as other characteristics which make a man a valuable employee. It is also necessary to distinguish between production on jobs in which the number of units produced accurately represents how much a man has accomplished and production on jobs in which the accomplishment is complex and may not even involve direct contact with specific units of production. It is the purpose

of the present chapter to describe methods for measuring these different aspects of work and to show how each is related to proficiency.

MEASUREMENT OF WORK ON PRODUCTION JOBS

A *production job* is characterized by the fact that quantity is the only variable which must be considered when we wish to measure the amount produced. In such a case counting the items produced is all that is required. Sometimes the parts produced can be delivered and recorded; in other cases various types of counting devices are available or can be designed. A satisfactory counting device is one which cannot be manipulated by the worker without his producing the desired product. Designing effective counters for the various operations is an engineer's problem and often requires ingenuity and inventive ability. Since the concern of this book is not with the construction of counting devices, but rather with the data which they make available, the nature of such devices need not be discussed in detail.

In actual practice, the items produced vary in quality, so that one cannot do justice to a man's output by mere counting. If a standard can be set up which demands that the product must be of a certain quality in order that it be acceptable, then this quality variable can be dealt with. Inspection methods which require that minimum standards be met take care of such qualitative features and permit measurement in terms of quantity, provided that proper adjustments are made for defective production. All items that are unsatisfactory represent a waste in material. The amount of loss, after salvage value is considered, can be translated into its equivalent of production units.

For example, let us suppose that each part which does not pass inspection represents a waste in material equivalent to one-half the value of the work expended in producing a good part. A man who produced ninety good parts and ten unsatisfactory parts would then be credited with producing eighty-five parts.

However, if the faults in the unsatisfactory parts are such that they can be corrected, such as errors in typesetting, unsatisfactory units represent partial production. Suppose the average man can correct twice as many units as he can produce. In such a case each unsatisfactory unit would have a value of .5. The man in our illustration would then be credited with producing ninety-five parts.

Whenever quality can be reduced to quantity by adjustments of this sort, individual production can be designated by a single score. Careful study of various kinds of work will suggest possible means for translating qualitative into quantitative features. To the extent that this can be done, measurement of work can be put on a purely production basis.

When men work in groups or teams, the production must be measured by the team score. In such cases men should be matched and team spirit encouraged. The men should have a voice in selecting team mates, and the company should co-operate in making desirable changes in the makeup of the group, since one slow or unco-operative individual can destroy the efficiency of the whole team.

MEASUREMENT OF WORK ON NONPRODUCTION JOBS: RATING SCALES

A *nonproduction job* is one in which the quality of the work plays a predominant part; this merely means that a complex pattern of quantities is involved in each unit of production. When a man's productiveness depends upon a variety of considerations, it is impossible to utilize simple quantitative procedures. The work of a fireman, a policeman, a foreman, and a schoolteacher are examples of jobs which do not easily lend themselves to simple quantitative measurement. In such cases, it has been found necessary to resort to human judgments to secure a measure of success on a job. Human judgments are subject to error, but, if the source of the error is known, these judgments can become

surprisingly trustworthy. When, however, we resort to this method, we are actually measuring more than a man's production; we are really measuring his merit or value to the company. Although productive ability is a very important aspect of merit, it must be recognized that merit is a more inclusive concept. We shall see later that measurements of merit also may be applied to nonproduction jobs. Fortunately, most employees doing similar work are engaged in production jobs, and, for these, merit and productive ability can be readily distinguished.

The *rating scale* is a technique by the use of which we judge members of a group by comparing them with each other. Thus, a foreman might be asked to give each of his men a letter grade of A, B, C, D, or E, according to his degree of proficiency and value on the job. This procedure seems little more than the usual method of passing an opinion on a man, yet it is a distinct step forward. Since the mere introduction of a grading system requires the rater to take some care in observing the work of the men, it encourages him to make comparisons between them. As soon as he makes such comparisons, the rater is less inclined to use himself as a model and is more likely to use the average man in his group as a standard. As pointed out in Chapter 6, an individual's ability has true meaning only when it is expressed in terms of its relation to the abilities of other people.

THE HALO EFFECT

The most common source of error in rating procedures is attributable to what is called the *halo effect*. Most human beings have prejudices which affect their ratings of other human beings. For instance, one foreman may consider promptness a virtue and give high ratings to those who get on the job ahead of time and low ratings to those who are occasionally late. Although promptness may be an important merit, it must not be confused with productivity. Another foreman may have nationality preferences, and still another may be influenced by personal appearance.

merit ratings. By this method the rater is asked to list the men in rank order from best to poorest. This is somewhat difficult and time-consuming, particularly when large groups are involved. Also, it does not take into account the possibility that the quality of the men may show considerable differences in the various departments. The man in the middle position of one department may actually be superior to one in the highest position in another department. As long as departments differ in the quality of the men whom they employ, it is difficult to know whether a man is rated high because of his own superiority or because of the inferiority of his associates.

Because this method is relatively time-consuming and, at the same time, introduces other difficulties, it is not widely used. However, since the training of raters and the defining of standards helps to bring the judgments of different raters closer together, the advantages of the order-of-merit method can be achieved, at least in part, in other ways.

IMPORTANCE OF DEFINING DUTIES

A third source of error in ratings arises when the rater does not know what qualities to observe in the men whom he rates. In other words, he does not know on what to base his ratings and must depend on his own opinion as to what constitutes a good performance of the particular job in question. The solution to this difficulty lies in analyzing the job into the specific functions or duties involved in its performance. These functions may also be spoken of as aspects of the job. These items can then be listed and each rater can judge his men in terms of their performance of these specific duties or functions. This procedure greatly increases the accuracy of rating.

As an example of this procedure, let us suppose that we wish to obtain ratings on the efficiency of foremen. We might break up the job into the following specific duties: (1) knowing the job; (2) getting co-operation from the men; (3) teaching new men;

and (4) handling emergencies. If a number of raters are available who are familiar with the work of a group of foremen, they can rate each foreman in terms of each function. They may use the letters A, B, C, D, and E, or the numbers 5, 4, 3, 2, and 1, to designate such estimates as superior, above average, average, below average, and unsatisfactory, respectively. By this method a given foreman might receive different ratings on each aspect of the job. Because the raters judge in terms of specific functions, rather than in terms of the job as a whole, differences in opinion as to what constitutes a good foreman are unimportant. Practically all rating blanks in use at the present time not only list specific functions for rating, but include as well careful definitions of these functions or duties.

REDUCING THE HALO EFFECT

The listing and defining of specific aspects of the job, however, does not entirely overcome the tendency of the halo effect to influence ratings. It is found that some employees tend to receive high ratings on their performance on all aspects of a job, whereas others tend to receive low ratings on all items. In other words, the correlation between ratings on a list of performances is definitely higher than the actual relationship between the performances. This fact shows that, when a supervisor rates his men on one duty, he tends to transfer this rating to other duties. This type of error can be reduced by preparing the rating sheets so that each page, instead of listing the duties, lists the men to be rated. The various duties on which ratings are to be made, therefore, occupy different sheets. According to this procedure, the rater is asked to compare all men on the basis of one function before the next one is considered. It is also desirable that the rating sheets be so arranged that a favorable rating sometimes requires a check on the right end of the scale and sometimes on the left. This variation in the rating sheets prevents the rater

from automatically checking a given position for a certain individual employee.[1]

The future of rating procedures in industry is promising. They are being improved constantly, and the results become more accurate with the training and experience of the raters. It should be pointed out also that some individuals show more skill than others in the ability to rate. As the specific aspects of different jobs become better known, further improvements can be made in the defining of these functions.

At the present stage of development, it is important not only to recognize the value of the rating methods, but also to be aware of their limitations. Because the simplicity of rating tends to make it a popular procedure, there are always the dangers that it will be inappropriately used and that too much importance may be attached to the measurements obtained.

WEIGHTING OF FUNCTIONS

After dividing the successful performance of a job into specific functions or duties, a difficulty still remains. Someone must decide on the relative importance of each function. If a foreman's score is taken to be the sum of his numerical ratings in each of the four categories listed above (page 135 f.), his score would fall between 20 and 4. This simple addition method would make all functions equally important. It is possible, however, that functions 1 and 2 are more important than functions 3 and 4. In such a case one could multiply the ratings on functions 1 and 2 by some constant value, such as 2. This procedure would weight the first two functions, making the range in score fall between 30 and 6 in our example. Another possibility would be to require minimum scores on certain functions. Thus, a man who rates less than average in a certain important category might automatically be

[1] S. N. Stevens, and E. F. Wonderlic, "An Effective Revision of the Rating Technique," *Person. J.*, 1934, *13*, 125–134.

given a zero rating in this function, or even be regarded as entirely unsatisfactory because he fails in the performance of an essential duty.

The proper evaluation of various functions is a complex statistical problem which is still under careful investigation. Only plants which have men trained in this type of work should attempt the higher degrees of refinement in weighting.[2] The ordinary supervisor may weight certain functions in the light of his experiences and, in this way, achieve considerable success. Even rough measurement is better than no measurement or prejudiced judgment.

CONCLUSIONS

The rating method is a refined procedure for utilizing human judgments in the measurement of production on complex jobs. By reducing the halo effect and by carefully defining the functions of a job, the effects of the most common sources of error are greatly reduced.[3] After this is accomplished, there remains a source of error which is more difficult to eradicate because the answer to the question as to what constitutes successful performance may be unknown. For example, various people may have quite different views as to what a successful foreman should be like. Until the definition of success can be determined more accurately, one cannot be sure that all the important functions are being rated and that each is being given its proper emphasis or weighting. In order to reach an objective and accurate definition of success, the nature of the job must be understood and specified. This takes us into the problem of job analysis in terms of abilities required to do the job. Many industrial psychologists are now engaged with this problem.

[2] J. Tiffin, *Industrial Psychology*, pp. 245–250.

[3] For a more complete treatment of rating procedures see H. E. Burtt, *Principles of Employment Psychology*, chap. XII.

JOB ANALYSIS AS AN AID TO PRODUCTION MEASUREMENT

THE JOB PSYCHOGRAPH

We have seen that ratings can be improved if the job is analyzed to some degree and the ratings applied to different aspects of the job. This procedure can be carried much farther if the job is analyzed in terms of the abilities required to do the job. A simple method for such an analysis is the use of the job psychograph.[4] A card is prepared, listing all the human traits which have a remote bearing on the job. A person familiar with the job is then requested to rate the importance of each of these traits on a five-point scale. By placing a check mark in space 1, 2, 3, 4, or 5, the rater indicates that he regards a given trait as negligible, barely significant, significant, of great importance, or of utmost importance. If a number of men who are familiar with the job make a psychogram, a composite psychogram can be made in terms of the average rating which each trait received.

A group psychogram largely eliminates non-representative ratings, such as those influenced by prejudice and halo effects. By connecting the ratings of the various traits with a line, a psychograph is formed. From the appearance of humps on the graph, one can readily recognize the traits which experienced judges regard as important.

Figure 13 shows the composite rating for a list of forty traits which might have a bearing on performance on the job of foreman. The raters were members of a class in War Training in industrial psychology; all occupied supervisory and administrative positions in war industries. The majority had college degrees, most of which were in engineering. These raters may be regarded as qualified in that they knew the duties of a foreman from first-hand experience.

Table 3 shows how different groups rate the same set of traits.

[4] M. S. Viteles, "Job Specifications and Diagnostic Tests of Job Competency Designed for the Auditing Division of a Street Railway Company," *Psychol. Clin.*, 1922, *14*, 83–105.

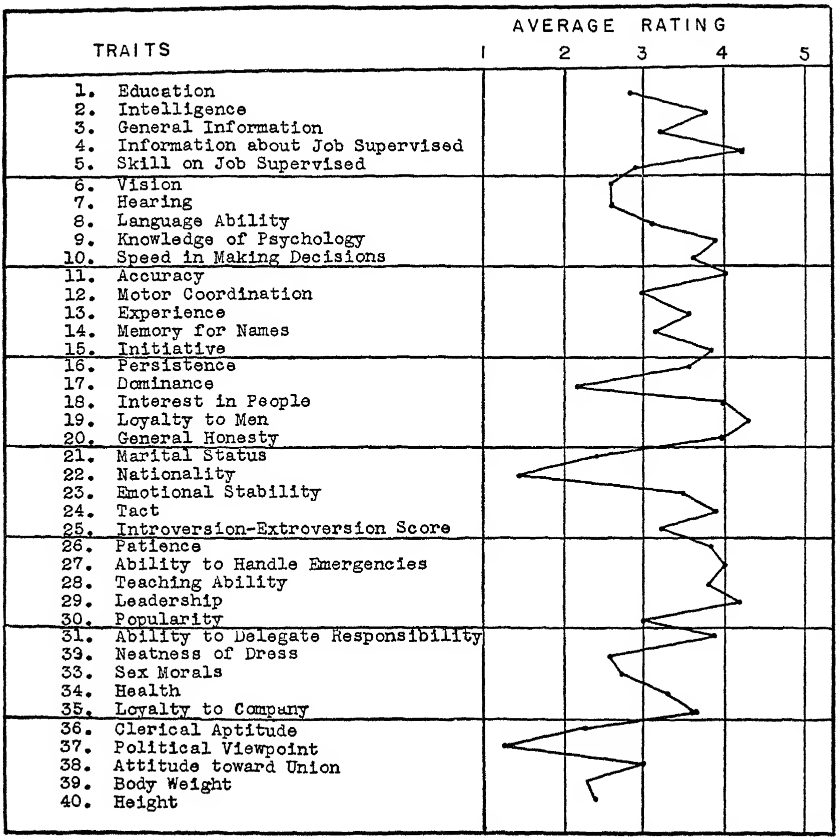

Figure 13. Composite Job Psychograph of Occupation of Foreman

The importance of the forty traits was rated by a group of industrial employees attending a War Training Class. By graphing the average ratings, the ralative importance of the various traits can be seen at a glance. Occupations can be compared by superimposing different job psychographs.

Group 1 consisted of 75 college students in a course in industrial psychology; Group 2, of the 23 members of a War Training class in Detroit; Group 3, of 14 men comparable in position and experience to Group 2, but having no training in psychology; Group 4, of 15 foremen in war industries; Group 5, of 15 officials holding responsible positions; and Group 6, of 15 ordinary workmen.

It will be seen that the ratings vary with position and experi-

Table 3. Average Ratings Given by Six Different Groups to Traits Influencing Foremanship

Trait	Group 1 *Campus Class*	Group 2 *War Training Class*	Group 3 *Control for Group 2*	Group 4 *Foremen*	Group 5 *Officials*	Group 6 *Workmen*
1. Education	2.8	2.8	**3.9**	3.0	2.9	3.1
2. Intelligence (I.Q.)	3.4	3.7	3.6	3.6	3.9	3.7
3. General information	3.0	3.2	2.9	3.3	3.6	3.1
4. Information of job supervised	4.8	4.2	4.5	4.6	4.5	4.5
5. Skill on job supervised	4.3	**2.9**	3.7	3.4	3.7	3.6
6. Vision	3.2	2.6	3.1	**3.7**	3.0	**3.6**
7. Hearing	3.3	2.6	3.3	**3.7**	2.9	**3.6**
8. Language ability	2.8	3.1	3.1	2.9	2.7	3.0
9. Knowledge of psychology	3.1	3.9	4.0	3.7	3.3	3.1
10. Speed in making decisions	3.9	3.6	**4.8**	4.3	3.8	4.2
11. Accuracy	3.9	4.0	4.5	4.1	4.1	4.3
12. Motor co-ordination	3.1	3.0	2.8	**3.8**	3.2	3.4
13. Experience	4.0	3.5	3.4	4.0	3.6	3.8
14. Memory for names	3.8	3.1	3.0	3.3	3.5	3.3
15. Initiative	4.0	3.8	4.0	4.1	4.2	4.3
16. Persistence	3.6	3.5	3.9	3.9	3.9	3.5
17. Dominance	**3.2**	2.1	2.0	2.1	2.1	**2.8**
18. Interest in people	4.2	4.0	**3.3**	3.8	3.7	**3.5**
19. Loyalty to men	4.3	4.3	4.4	4.1	4.4	4.4
20. General honesty	**4.1**	**4.0**	4.6	4.5	4.9	4.6
21. Marital status	1.9	2.4	2.2	**3.1**	2.6	2.3
22. Nationality	1.9	1.5	1.3	**2.8**	1.9	1.5
23. Emotional stability	**4.1**	3.5	3.8	3.3	**4.3**	3.5
24. Tact	4.3	3.9	3.9	3.8	4.3	3.8
25. Introversion-extroversion score	**3.8**	3.2	2.6	3.3	2.7	2.6
26. Patience	4.2	3.8	4.2	4.1	3.8	4.2
27. Ability to handle emergency	4.4	4.0	4.3	4.1	4.1	4.4
28. Teaching ability	4.1	3.8	3.8	**4.5**	4.1	3.9
29. Leadership	4.5	4.2	**3.8**	4.8	4.4	4.4
30. Popularity	**4.2**	3.0	3.5	3.4	3.1	3.6
31. Ability to delegate responsibility	4.0	3.8	3.9	4.2	4.1	3.9
32. Neatness of dress	**2.3**	**2.5**	2.9	3.1	3.1	3.1
33. Sex morals	2.1	2.7	3.4	**4.1**	**4.1**	3.5
34. Health	**2.5**	3.3	4.0	**4.4**	3.9	4.0
35. Loyalty to company	**3.8**	**3.6**	4.0	4.3	**4.8**	4.1
36. Clerical aptitude	**1.5**	**2.3**	2.7	3.0	2.9	2.8
37. Political viewpoint	1.6	1.3	1.3	1.7	1.3	1.5
38. Attitude toward union	2.8	3.0	2.6	2.5	2.7	**1.9**
39. Body weight	2.3	2.3	1.8	1.9	1.9	1.6
40. Height	2.4	2.4	1.9	1.9	2.0	1.8
Average	3.39	3.21	3.37	3.56	3.45	3.40

ence, but even officials and workmen show striking agreement. The ratings in each group which are unique are shown in bold-face figures in the table. The fact that the number of bold-face items is so small indicates a surprising degree of agreement among these varied groups of men.

Group 1 regards dominance, emotional stability, the introversion-extroversion score, and popularity as more important than do the other groups. The campus students discount the importance of honesty, neatness of dress, health, loyalty to company, and clerical aptitude. Group 2 discounts the same items, and, in addition, is unique in discounting the item, "skill on job supervised." The discussions of halo effects to which these groups were exposed have perhaps influenced their ratings on the items they both discounted. Group 3 regards education and knowledge as relatively more important than do the other groups, but gives interest in people and leadership relatively low ratings in comparison with other groups. The ratings of Group 4 are characterized by overemphasizing most of the traits, and this tendency has caused their average ratings to be above the averages of the other groups. Vision, hearing, motor co-ordination, marital status, nationality, teaching ability, sex morals, and health are the items most exaggerated by the foremen. The company officials in Group 5 give weight to emotional stability, sex morals, and loyalty to company, the latter receiving the second highest rating of any trait. Group 6, consisting of workmen, showed ratings which were strikingly consistent with the other groups. Like the foremen, they rated vision and hearing relatively high; like Group 1, they rated dominance somewhat high; and, like Group 3, they rated interest in people high. They were unique only in rating attitude toward the union as a relatively unimportant trait in foremen.

A comparison of the ratings given by different groups of people shows that none is in a unique position for analyzing a job. Certainly, the workmen seem as capable as foremen and officials in

The item on which there was most agreement as to its importance was "information of job." This item was among the top five for all six groups. Loyalty to men, honesty, and leadership were among the top five items in five of the groups. No other items appear in the top five ratings of four or three of the groups. It is only on these four items that marked agreement appears. This indicates that information of the job supervised, loyalty to men, honesty, and leadership should be carefully analyzed in determining skill in foremanship. Of particular interest is the fact that three of these four items are personality characteristics.

THE EMPIRICAL METHOD

The psychographic method analyzes a job in terms of human traits, but it does not escape direct dependence upon human opinions, even though the opinions may be those of experts. To escape this source of error, it is necessary to use more time-consuming procedures. The empirical method largely escapes the element of human opinion by comparing extremes.

Suppose we select for study a group of sixty men in a certain occupation. These men are then rated by supervisors (or individuals who have observed their work) on a five-point scale according to their proficiency. The score of each man is the average of the supervisors' ratings. Thus far, the method utilizes the relatively crude rating procedure.

The next step is to divide the men into three groups, according to the scores attained. The one-third achieving the highest ratings are labeled superior workers; the third obtaining the lowest scores are labeled inferior workers; and the middle third, making intermediate scores, constitute the average workers. Conceding that errors in ratings have occurred, it is apparent that these have resulted in placing some men in the middle group who belonged in either the lowest or the highest groups, and placing some men in the two extreme groups who should have fallen in the middle group. The placing of inferior individuals in the

superior group or the placing of superior individuals in the inferior group would occur very seldom. If we now ignore the middle group, and consider only the superior and inferior groups, we have two distinctly different samples of employees.

The next step is to study carefully the mental, physical, and personality traits of these two groups. Examples of traits which may be measured appear in the psychograph on page 140. Any trait which is associated with success on the job should appear in different degrees in the two groups, and, within each group, this trait should appear to a fairly uniform degree. By subjecting the groups to various measurements and tests, we may obtain many bases for comparison. By this method quite unexpected relationships are often found.

In a study of meter-readers, it was found, for example, that the ratio of a man's weight (in pounds) to his height (in inches) was one of the most important items.[5] For the ideal meter-reader the ratio was 2 to 1. Other traits selected as pertinent by supervisors turned out to be unrelated to success. This method frequently reveals that supervisors cannot always choose the important traits associated with success.

In comparing the two samples of employees, the importance of some traits becomes obvious by mere inspection. In other cases differences in the averages clearly reveal the importance of a trait. Sometimes it is necessary, however, to compare the distributions of a trait in the two samples. For example, an average amount of intelligence may be associated with success, whereas either high or low intelligence is associated with failure. A job may be too difficult for a man of low intelligence, so that he never can do the work satisfactorily. At the same time it may be too easy for a man of superior intelligence, and so make him inattentive and bored. It would not be surprising, for example, if Einstein turned out to be an inferior motorman. It is not infrequent that a specified amount of a trait is associated with success. When this

[5] A. Ford, *A Scientific Approach to Labor Problems*, p. 45.

occurs, a comparison of averages does not reveal its importance because the average of ten superior and ten inferior men may be exactly the same as the average of ten men each of whom make an approximately average score.

This method not only permits us to locate objectively the more important traits, but allows us to determine their relative importance. The scores on the most important traits would show the most clear-cut differences in the two samples, and these could be given more thorough consideration.

After determining the traits which are important for success on a non-production job, it may be necessary to revise our notions as to what factors determine success. For instance, suppose that application of the empirical method revealed that teaching ability was approximately the same in a group of inferior and in a group of superior foremen. This being the case, it would be inadvisable for supervisors to place undue emphasis on rating foremen on their teaching abilities. Rather, they should set up as criteria of success abilities in those aspects of the work which were more pertinent to success. Job analysis thus aids in detecting the aspects of a non-production job to which rating procedures should be applied, making possible the listing of the items on which the worker should be rated. Since this list gives the rater a definite basis on which to rate, he can, to a large degree, avoid the errors due to prejudice, to halo effects, and to his tendency to use himself and his abilities as standards of success.

Job analysis, however, has importance beyond that of improving rating procedures. Once a job is analyzed in terms of the traits essential to success, tests can be devised to measure these traits. By utilizing the results of these tests, men can be placed on jobs which best fit their particular abilities. The use of tests for the selection and placement of employees is discussed in the following chapters.

MERIT RATING

We have seen that the application of a refined rating method is the only way to obtain a measure of productivity or proficiency on non-production jobs. Despite its deficiency, it has virtues which have caused it to be used for evaluating men on production jobs. Although the counting method is the best measure of a man's production, it does not completely reflect his value to the company. A man's personality may influence the production of his fellow men; his carelessness may give rise to accidents; his tardiness may delay the work of a whole group of men; or his inventiveness may result in the development of improved methods of production. Because factors other than production are important, one must distinguish between a man's productive ability on his job and his merit or value to the company. For this reason, test scores should be correlated with merit as well as with productivity.

Since merit depends upon a variety of abilities, it can be measured only by rating procedures. Thus, we find that when we consider the merits of men, we practically drop the distinction between production and non-production jobs. When using merit ratings on production jobs, the same procedure is followed as that described for measuring ability on non-production jobs. As previously pointed out, measures of proficiency on non-production jobs are practically ratings of merit.

The only difference between productivity and merit in non-production jobs is one of emphasis. If job accomplishment is emphasized, the ratings to a great degree represent production measurement, but if dependability, potentiality for advancement, and pleasing personality are emphasized, then the ratings are more closely analogous to merit.

In selecting and promoting men, merit is perhaps more important than productive ability; nevertheless, it is desirable to distinguish between them whenever separate measurements can be

made. The conditions which improve a man's merit do not necessarily improve his skill or work accomplishment, so the distinction helps in determining what conditions to correct. Further, if one is investigating the effects of supervised training, rest periods, and various incentives, it is desirable to know whether plant production has improved, or whether the new conditions have altered the employee's merit in a more general way. Since the more general improvement may eventually lead to increased production, it represents management's interest in a long-range point of view.

DIRECT AND INDIRECT BENEFITS OF MERIT RATING

The use of merit ratings may be expected to improve directly the selection of men for various jobs, since correlations between merit and test scores will indicate the use of tests which are most diagnostic of merit. Improved selection methods lead to the employment of superior workers, so that production is increased without increasing the overhead. In addition, the method of merit rating introduces some indirect benefits or by-products:

1. The men know that their efforts are being observed, and they can be told how they stand in relation to other men in their group. By having periodic ratings, each man can learn whether or not he has improved, since his own previous record gives him a reasonable standard with which to compare his present standing. This is desirable because, if he compares his record with that of very superior workers, he is likely to become discouraged; if he compares it with that of inferior men, he is likely to let down; but if he compares it with that of equals or with his own previous record, these dangers are avoided. Reasons for these human reactions are discussed on pages 244–247. Other beneficial effects follow because of improved attitude, the importance of which was considered in detail in Chapter 3.
2. If a supervisor is required to make ratings of his men,

> he must analyze them, rather than merely judge them as good or bad. As a consequence, he will be more likely to change his opinion of a man as successive ratings are made. The supervisor is also expected to talk things over with the men. Frank discussions will benefit workers, in that the men can learn about their weaknesses; they will likewise benefit the supervisor, in that they will help him to understand the job from different points of view, as well as help him to know each man as an individual. They thus give him a broader insight into men, and suggest aspects of the job in which special training may be instituted.

These by-products are thus beneficial to the workers as well as to the supervisors. In many cases these indirect benefits may exceed the direct benefits in importance, particularly because they tend to influence labor-management relations.

The value of rating methods in industry is apparent from the fact that their use is becoming more and more widespread. A recent survey showed that about one-third of the industrial establishments utilize ratings of merit, although the types of scales and the extensiveness of their use vary from company to company.[6] It is desirable, in all cases, that the procedures be adapted to the needs of the company and that the methods be improved as new developments are made in the field. Since the practical problems involved are often complex, for best results the administration of the program and the analysis of results should be in the hands of trained personnel.

BASIC IMPORTANCE OF PROFICIENCY MEASUREMENT

In introducing psychological procedures in industry on a large scale, it is apparent that production and merit measurements are an essential preliminary to the utilization of many other features. We know that individuals are very different in

[6] Starr, R. B., and R. J. Greenly, "Merit Rating Survey Findings," *Person. J.*, 1939, *17*, 378–384.

the degree to which they can produce, but it is only through the measurement of their productive ability that these differences can be fully appreciated and utilized. Production measurement is also a prerequisite to job analysis in terms of ability; consequently, it is basic to the proper selection and placement of the worker. It likewise aids in the analysis of jobs in terms of movements, since the work methods of good producers frequently contain short cuts which may be taught to others. However, before we can study the techniques of the most highly proficient workers, we must know who they are.

Production measurement is also of great importance to the problem of remuneration and promotion. Efforts should always be made to retain the superior employees, and this requires accurate and fair measurement of merit if dissatisfaction and jealousies are to be kept at a minimum. If morale is low among workers, it is important to know whether this dissatisfaction is associated with productive ability.

As will be seen later, accidents and mistakes are frequently individual matters, and, since they inevitably occur, it is desirable to know to what extent they are more common among fast than among slow workers. Similarly, factors in the job environment influence different people to different degrees and in different ways. Suppose, for example, that employees complained that noise in the factory made them nervous and caused them to make errors. Without measuring the production of each individual before and after the use of protective devices for the ears, it would be difficult to know the degree to which the problem was general and the degree to which it was a relatively limited, individual matter. If it is an individual matter, transfer of affected employees to more quiet work would solve the problem, but, if the effect is general, then methods for eliminating noises would have to be found in order to solve the problem.

The above discussion serves to show how production measurement is directly involved in a variety of industrial questions

which are of sufficient importance to warrant the adoption of a measurement program. The by-products of improved morale, already mentioned, make the case even stronger. Taken together, the results may be expected to lead to increased production and decreased industrial strife.

8 THE USE OF PSYCHOLOGICAL TESTS IN INDUSTRY

INTRODUCTION

Psychologists have been employed more frequently in the selection of personnel than in any other phase of industry. That psychological testing has an obvious application to employee selection has been recognized by many large industries, which have not only welcomed the application of existing tests, but have co-operated in the development of new ones.

It is sometimes supposed that selection methods are important only when there is a surplus of labor. During periods of labor shortage, it is agreed that industry cannot choose, but must take what it can get. From this point of view, it might appear that industry should favor economic conditions which create a labor surplus. However, this position fails to recognize the fact that selection methods are essential to the proper placement of labor and that this need is always present. Further, any industry which has an unusually favorable labor record can always select its employees. Even during labor shortages, such companies have a waiting list and thus have the pick of the labor market. When the vast differences in ability among people are fully recognized, it becomes apparent that a favorable reputation as an employer is a sound investment.

A testing program requires the employment of a trained psychologist if it is to be properly administered. Tests must be interpreted, and statistical methods must be employed in their application. Further, pertinent tests must be selected from the large

number available, since some tests which have been widely publicized are of very little use. Such selection must be made by a person who is qualified to evaluate the mass of available material. Such a person may also find it necessary to develop new tests to meet the needs of the particular concern by which he is employed.

The field of testing is a technical branch of psychology, and a complete treatment of the subject cannot be given in a general survey such as this. Therefore, we shall confine our discussion of psychological tests to showing how these instruments are used to analyze jobs in terms of ability and to a general treatment of the nature of tests. Readers who are especially interested in the administration of tests should have a good background in both general and industrial psychology as well as special training in testing methods.

HOW TEST SCORES DEFINE ABILITY

The use of psychological tests in industry presupposes that a satisfactory criterion for success on a job is available. In the preceding chapter, methods for arriving at such criteria were discussed. Since both test results and measurements of job performance are expressed quantitatively, the degree of relation between the two measures can be determined. After such correlations are obtained, it is possible to define the desired abilities in terms of a test score. This is an important advantage, since it replaces ambiguous and subjective descriptions of human abilities with objective and quantitative scores. For example, an intelligence test score revealing an I.Q. of 100 has a meaning which does not depend upon a particular person's definition of intelligence. The test really defines the ability so that one can say that intelligence is that which the intelligence test measures, and that a score of 100 is the one which is made by the average person. If such an ability is desired for a job, it is clear to other testers just how to locate such individuals.

Well-constructed tests are known to measure some aspect of

human ability. As long as such tests succeed in measuring the abilities related to success, it is irrelevant whether or not one agrees with the name given to the ability measured. If we know what men should accomplish with their abilities, tests can be constructed to measure the desired abilities. By this procedure, psychological tests become objective instruments for measuring even the most elusive human traits.

THE USE OF MINIMUM TEST SCORES IN SELECTION

If the score on a given test shows a marked correlation with the criterion for success on a job, it is possible to find a score which is seldom made by inferior workers, but which is frequently made by satisfactory and superior workers. In the scatter diagram shown in Figure 14, the score on a test is plotted against the

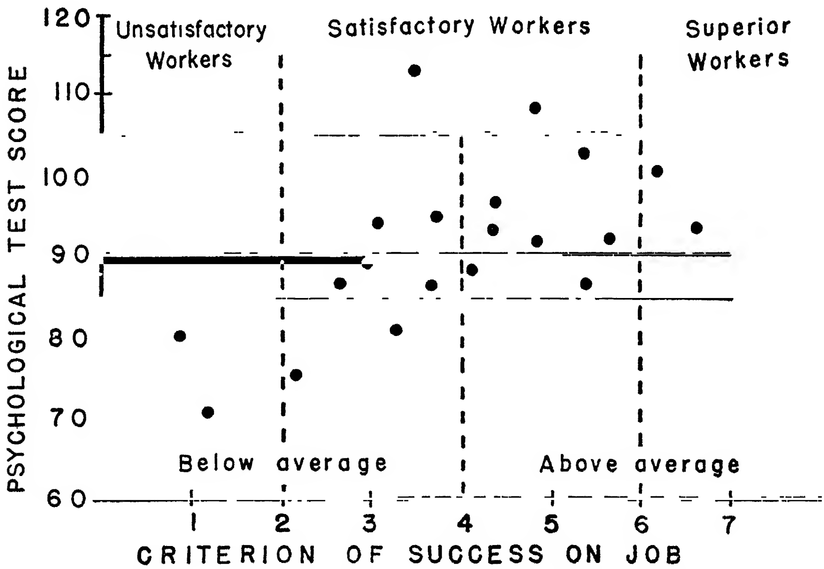

Figure 14. The Use of Maximum and Minimum Scores in Selection

When psychological tests show relationships with production, selection can be improved by employing only individuals who make a minimum score. The line drawn opposite to score 85 eliminates four individuals, each of whom produces less than an average amount. If applicants who score between 90 and 105 were hired, seven out of nine would tend to be above average ability on the job.

criterion for success. Each dot represents a workman. Suppose that employees with a ranking of less than 2 are unsatisfactory; those with rankings between 2 and 6 are satisfactory, and those with rankings of 6 or better are very superior workmen. It will readily be seen that, if a score of 85 on a psychological test was prerequisite to employment, four men would not have been hired. The exclusion of these four would have eliminated the two unsatisfactory employees and two others who are satisfactory, but nevertheless below average. If a minimum score of 90 was used as a prerequisite, then five additional workers would have been eliminated, all of whom are satisfactory, but none of whom is superior. By using minimum test scores in this manner, it is possible to improve greatly the selection of employees.

In one company, some of the employees were hired on the basis of the old method, and some on the basis of minimum scores on intelligence tests.[1] This procedure permitted a comparison of the results of the two methods. It was found that the previous methods of hiring resulted in the employment of 22 per cent outstanding employees, 48 per cent satisfactory employees, and 30 per cent unsatisfactory employees. The method of using minimum scores on an intelligence test as a basis for hiring resulted in the employment of 32 per cent outstanding employees, 62 per cent satisfactory employees, and only 6 per cent unsatisfactory employees. The company thus was able to select 10 per cent more outstanding employees and 24 per cent fewer unsatisfactory employees by using the minimum score on an intelligence test. It must be pointed out that the minimum score used in this investigation varied from job to job. For certain manual tasks, the minimum I.Q. was 90, on clerical work it was 100, and for more complex work it was even higher.

The use of a minimum score takes into account the fact that a certain amount of a specific ability is a prerequisite to proper

[1] H. Musgrave, "Industrial Psychology," Part 8 in *Fields of Psychology*, pp. 361–374.

performance on a job. If a person has this given amount of ability in the trait under consideration, then the presence of sufficient amounts of other abilities may become even more important than a greater degree of the specific ability. For example, a given amount of intelligence may be essential to understand certain relationships in the operation of a machine. If this degree of intelligence is present, then good manual dexterity may be more of an asset than more intelligence; but, if the necessary intelligence is not present, then no amount of dexterity would compensate for the mental deficiency. For this reason, a minimum score may be very selective even when the correlation between merit ratings and a test score is not very high. High correlations are based upon situations in which further amounts of ability in a given trait continue to be important. On some jobs, it is even desirable to use maximum scores, since a simple job may be monotonous to a highly proficient individual. When maximum intelligence test scores are used, a person is required to have less than a certain amount of intelligence to qualify for the job which is under consideration.

In many occupations, a high degree of intelligence may be nearly as undesirable as too little. In such cases one may specify that a score must fall between two extremes. From inspection of Figure 14, it will be seen that the two highest scores on the test were not made by the most superior workmen, indicating that scores above 105 do not result in increased efficiency. This suggests that scores between 90 and 105, for example, would yield the most superior workmen on a certain job. Half of the twenty men have a rating of 4 or less, and only two of these make scores between 90 and 105. The other half have ratings above 4 and represent the better half of the workmen. Of these ten superior workers, seven make scores between 90 and 105 on the psychological test.

After maximum and minimum scores on tests are determined for various jobs, one can make better than chance predictions with

regard to the type of position in which the applicant is most likely to succeed. The reliability of this prediction can be increased if a series or battery of tests is used. Such a battery should be made up of a group of tests, each of which is related to success on the type of work being analyzed, but none of which shows a marked relation with any of the other tests. Because special abilities tend to be unrelated, the selection of a group of unrelated tests insures the measurement of different aspects of a job's requirements. A battery of correlated tests would merely tend to duplicate measurements of the same abilities, and the degree of correlation between pairs of tests would indicate the extent to which they overlapped in their measurements.

All jobs require the functioning of a pattern of abilities. Some of these abilities are phases of intelligence, others are forms of motor co-ordination, and still others may be associated with personality. Certain tests in each of these areas may show definite relations with job success. It is clear that a person who qualified on all the diagnostic tests would have a better chance of succeeding than one who qualified on some of the tests. The utilization of a number of tests thus serves to give a more complete picture of the job requirements.

FACTORS WHICH INFLUENCE THE VALUE OF PSYCHOLOGICAL TESTS IN SELECTION

THE DEGREE AND NATURE OF THE RELATIONSHIP BETWEEN TEST AND CRITERION

The results of tests which are highly correlated with the criterion of success on a job are obviously more accurate in selecting employees than are less highly correlated tests. For this reason, it is important to strive for highly refined tests and the development of more complete batteries of tests for specific types of work. When the relationship between tests and the criterion holds only for a limited range of test scores (that is, when low and high scores tend to go with deficient performance on the job,

and intermediate scores are related to proficiency), then the degree of correlation for the test as a whole is lowered by the inclusion of the whole range of scores. We have seen, however, that the use of minimum and maximum scores can correct for such causes of low correlation and still allow a test to be diagnostic. The value of a test thus varies with the nature of the relationship between test and criterion, as well as with the degree of this relationship.

THE PROPORTION OF SATISFACTORY AND UNSATISFACTORY EMPLOYEES

If a small proportion of employees are satisfactory on a job, it follows that selection methods may eliminate a large number of potentially unsatisfactory employees, thereby greatly increasing the proportion of satisfactory ones. On the other hand, if most employees are satisfactory when selected at random, there is less room for improvement by selection methods. The degree to which this factor influences the value of a test can be determined from statistical tables.[2] For example, if 10 per cent of the employees are satisfactory when no tests are used, then a test which correlated .5 with the criterion of proficiency would raise the proportion of satisfactory employees to 17 per cent (70 per cent improvement), provided one out of every two applicants could be rejected. If 80 per cent of the employees were previously found to be satisfactory, however, a similar test would raise the proportion of satisfactory employees to 91 per cent (14 per cent improvement). Thus the extent of improvement varies with the ratio between satisfactory and unsatisfactory employees.

The need for selection methods increases as the problem of finding satisfactory employees becomes more difficult. Fortunately, it is in the elimination of unsatisfactory employees that the testing program has the most to contribute. Jobs differ con-

[2] H. C. Taylor, and J. T. Russell, "The Relationship of Validity Coefficients to the Practical Effectiveness of Tests in Selection," *J. Appl. Psychol.*, 1939, *23*, 565–578.

siderably in the ease with which satisfactory employees are found to fill them, and, in general, this selection problem varies with the complexity of the occupation. Thus complex occupations have more to gain from employee-testing than simple occupations. It must be pointed out, however, that oftentimes the number of "unsatisfactory" employees is low because the employer regards his employees as satisfactory even when they are relatively ineffective. A rise in standards has the same effect as an increase in the complexity of a job, because the ability requirements are extended.

THE SELECTION RATIO

Other things being equal, the effectiveness of employee selection can be increased by reducing the proportion of applicants hired for a job. If 20 per cent of the applicants are chosen, the same test will serve a better purpose than if 80 per cent must be chosen. Suppose a test shows a correlation of .5 with the criterion of success on the job and that 50 per cent of the employees are satisfactory when selected at random. Under such conditions, the hiring of 20 per cent of the applicants would increase the number of satisfactory employees to 78 per cent, whereas the hiring of 80 per cent of the applicants would increase the number of satisfactory employees to 57 per cent. The selection ratio thus plays an important part in determining the value of selection methods.[3]

The selection ratio adopted will naturally vary with the available labor supply. However, employers with good labor reputations can usually have a waiting list from which to choose. By testing all applicants, such employers can select with discrimination and place prospective employees in occupations to which their particular talents are most suited.

[3] Tables developed by Taylor and Russell, which show the effects of the selection ratio for various degrees of correlation and for various proportions of satisfactory employees, are reproduced in Tiffin, *op. cit.*, pp. 363–367.

THE NATURE OF HUMAN ABILITIES

The abilities involved in almost any kind of work are not only numerous, but varied in kind. Each of the abilities is highly specific, so that one cannot even speak of muscular co-ordination without specifying the kind of co-ordination. Add to this problem the fact that each job involves a pattern of abilities and traits, and that this pattern varies from job to job. A skilled carpenter, for example, must have a variety of kinds of muscular co-ordination; a considerable degree of ability to learn; the ability to judge distances, make measurements, figure out angles; have a certain amount of endurance and strength; good balance; adequate eyesight; be able to plan work for himself and his assistants; be able to get along with his assistants and his employer; have sufficient interest and perseverance to learn the job and keep at it; be careful to avoid accidents; have a sense of responsibility and honesty, so that he will use proper materials even where they do not show; and many other abilities and traits. This list of characteristics includes personality traits, mental traits, muscular functions, and sense-organ functions. Some of the abilities are dependent upon experience; others are quite independent of experience and are purely dependent on good development and heredity.

It is apparent that it is impractical to measure separately each specific ability essential to a given type of work. For most purposes, a cross-sectional measure of certain areas of ability will serve the purpose. A psychological test, therefore, frequently gives a composite picture of a number of abilities. The method is similar to that used in the measurement of physical traits, where, for example, we know that the height of a child is dependent upon the length of his legs, his trunk, his neck, and his head, yet for most purposes we are satisfied to indicate his growth rate by combining all of these measures. When accepting the over-all body measurement, it is important to realize that all parts of the body do not grow at the same rate and develop at the same time,

and that two children who are of the same height are not alike in body proportions. Similarly, it is important to understand that most psychological tests give a composite measure of a number of functions and that equal scores do not indicate identical abilities.

Different tests are designed to measure different general areas of ability. In some cases, the area may be very limited and the test becomes relatively specific; in others the tests measure a large area and are relatively general. Tests are also designed to measure functions which are influenced by learning, and others which are native or natural to the person. Finally, some tests must be administered individually, whereas others are designed so that large groups may be tested at the same time. The equipment necessary for administering the tests varies greatly; some tests require elaborate instruments; others are purely the paper-and-pencil variety. To interpret test results properly, it is highly essential that these distinctions between tests be made. The assumption that a composite test score measures something highly specific, or that a relatively specific test measures a large pattern of abilities, has led to much misinterpretation. Failure to distinguish between tests influenced by learning and those not so influenced has led to the fallacious comparison of experienced and inexperienced individuals. Since each test is designed to serve a given purpose, it performs a specific function. The wise tester keeps these limitations in mind and constantly improves his selection of test materials so that they become more and more diagnostic.

TYPES OF TESTS

INDIVIDUAL AND GROUP TESTS

People must be tested individually when some performance on an instrument or a piece of apparatus must be measured, or when the time for the completion of a task must be recorded. Tests for car-driving ability, ability to assemble small pieces of equipment,

and insight in fitting blocks together are examples of test situations requiring individual administration. Such tests permit a greater variety of observations and measurements than do group tests. For the skilled tester, these casual observations often supply added information which may be useful. Individual tests have the added virtue of not requiring language ability, so can be used with illiterates and foreign-speaking populations. One can readily observe whether the person tested is in the proper condition to do himself justice and thus avoid certain errors.

The great advantage of group tests lies in their economy of effort and time. Because of this advantage, attempts are constantly being made to devise group tests which will measure the same things as are measured by certain individual tests. Group testing is most satisfactory for measuring attitudes, mental abilities, and information, since these functions can be reduced to language.

APTITUDE AND ACHIEVEMENT TESTS

Aptitude tests are designed to measure a person's potentiality for succeeding in certain tasks. Aptitude, therefore, refers to a man's abilities before he is subjected to training in a specific task. His aptitude thus depends upon the abilities he has developed through heredity and growth and the extent to which these have been improved through exercise and experience in general.

The purpose of aptitude testing is to obtain, before training, an indication of how well a man will perform a job after he is trained for it. It is well known that men with the same training still show great differences in their performances on a job; the cause of these differences lies in the dissimilarities in aptitude. Aptitude tests are therefore so designed that certain kinds of experience do not influence the score attained. In some instances, items of information are included in the test, but in such cases the exposure to the information is so common that the individuals

with the necessary aptitudes would have acquired the information.

Intelligence tests, for example, are aptitude tests in the sense that education and experience have little or no effect on the score. Frequently, the term *aptitude test* is used in a more restricted sense and refers to tests of highly specific abilities, such as finger dexterity and tapping speed. Nevertheless, the function of aptitude testing is always the same in that it measures untrained performance on a task, regardless of the nature of the task.

The majority of the tests now used are aptitude tests. These vary so much with the nature of the ability tested that it is best to delay a more detailed description of their nature until the next chapter, when the different types of tests are discussed.

Achievement tests measure the performance of an individual after training, thus making the scores on such tests dependent upon both aptitudes and experience. Persons with the same pattern of aptitude but with different amounts of experience would vary in their achievement scores. Achievement-test performance, therefore, improves with training on the job. Two men who show equal ability in performance on one occasion may be quite different in performance on a later occasion. For example, suppose that a man with one year's experience shows the same achievement as that of a man with three years' experience. The fact that the man with the lesser experience equals the achievement of that of the other indicates that the former has the superior aptitude. Two years later, it may be expected that the man with the lesser experience will surpass the achievement of the other. The difference between three and five years' experience is not so great as that between one and three years' experience. As experience increases, the returns in the form of improvement diminish, but the original difference in aptitude remains the same. The very fact that one man can do as well after one year's experience as another can do after three years' experience shows that the former is better fitted to learn the operations required than is the latter. Employers frequently err when they choose the men with the greatest amount of experience.

Achievement tests are used when hiring men for a job that requires training, but for which the company cannot institute the training. When carpenters, tool-makers, and lathe operators are needed, one cannot be satisfied with their potential skills or take the pains to train them for industry in general. The employer, therefore, advertises for men skilled or experienced in certain operations and wishes to select those most qualified at that particular time. Since men who wish to obtain employment frequently claim experience which they do not have, it is desirable to have tests which differentiate between them.

The most accurate way to measure achievement on any job is actually to try men out on the work. In some cases this would really mean the adoption of a system of temporary employment for a probationary period. This method is obviously costly, both because it involves excessive employment and because of the damage to machinery and injury to workers which it entails. The next best thing is to devise tests which will measure certain essential qualifications.

Since the purpose of an achievement test is to measure how well a person can do a given kind of job, the test frequently duplicates many of the operations and problems confronting the worker on the job. In testing punch-press operators by means of a miniature and hazardless facsimile of the actual machine, it was found that experienced punch-press operators scored definitely higher than untrained persons and workers skilled on other machines.[4] The test thus readily differentiated between trained and untrained persons.

Achievement tests of this sort also have value as aptitude tests, particularly when given to untrained individuals. By testing their accuracy under various conditions as well as their rates of improvement from one test period to another, one obtains a measure of the learning aptitudes which are essential for specific operations.

Frequently, such miniature equipment also has value for training purposes. This is particularly true when the operations on the job are complex and dangerous. The Link Trainer is an intricate piece of apparatus which duplicates the essential operations in piloting a plane and is extensively used for training pilots. Experience on the Link Trainer significantly shortens the training period for airplane pilots, and is without hazard. It is particularly valuable in training pilots in instrument flying.

All trade tests come under the heading of achievement tests. Most of these tend to sample trade knowledge by questions and pictures. Such tests are similar to those examinations in school and college, the purpose of which is to determine how much a student has learned about a subject. Obviously, one's knowledge depends upon the amount of exposure to the subject matter (experience) as well as upon one's ability to absorb such knowledge (aptitude). Tests are now available for measuring achievement in a variety of activities, but much still remains to be done.[5]

AREAS OF HUMAN ABILITIES

The characteristics of man may be divided into four general areas: (1) the mental abilities; (2) muscular or motor co-ordinating functions; (3) personality characteristics or traits, including temperament and emotionality; and (4) physical and sensory capacities. Little or no relationship appears to exist between these four areas of ability, so that all must be sampled in any over-all description of an individual. Each area is likewise made up of a large number of highly specific abilities which, on the whole, are unrelated; but different combinations of them may be closely associated in the performance of specific tasks.

The relative importance of these areas varies greatly, depending upon the nature of the job. Occupations which require persons to work without close supervision, and which necessitate judgment

[5] For a description of tests see E B. Greene, *Measurements of Human Behavior*, pp. 187–263; also J. Tiffin, *Industrial Psychology*, pp 95–110.

and resourcefulness, or occupations which demand planning, clerical operations, computations, and the like, clearly depend on the mental abilities.

When occupations require routine manual operations of a repetitive nature, or when speed is an important factor, the motor abilities become important. If trade knowledge, as well as manipulative ability, is required, then both mental and motor abilities are necessary.

Positions which involve dealings with others, such as supervisory work, instruction, and personnel management, make demands on certain personality traits. Since many of these positions require knowledge and judgment as well, mental abilities are also implicated.

Specialized work which calls for unusual strength, endurance, or agility requires certain body builds for the attainment of high degrees of proficiency. It is not surprising that some occupations have been found to be better adapted to women's hands than to those of men. Forms of work which demand close or far vision, keen judgments of distance or color, acute hearing, or fine development in some other sensory capacities depend largely upon the special sensory abilities associated with the task. Since many of these rather special forms of work demand manipulation, motor abilities are also involved to varying degrees.

It is apparent that the analysis of jobs in terms of abilities is rather complex. However, once the essential abilities are known, the pertinent measurements of the applicant can be made, and men can be effectively fitted to occupations which suit their abilities. At present, the psychological analysis of jobs and the measurement of human abilities have progressed sufficiently to make their use a sound investment. The number of industries using psychological tests is increasing, and there is every indication that this trend will continue. The programs carried out in the Army and Navy may be expected to produce new advances in human measurement as well as testify to their value.

9 THE GENERAL NATURE OF PSYCHOLOGICAL TESTS

THE MENTAL ABILITIES

THE MENTAL ABILITIES are largely associated with the higher brain centers. They include such functions as learning, memory, flexibility in thinking, seeing relationships (commonly called insight), alertness, speed of thought processes, and creative or inventive reasoning. Since there is some relationship between all these functions, it is possible to give a composite measure of this group of abilities without greatly misrepresenting any one of them. The term *general intelligence* is now commonly used by psychologists to designate this group of abilities.

INTELLIGENCE TESTS

The intelligence test is designed to measure ability in this general area which we have called mental. Since the score on an intelligence test tends to be correlated to a greater degree with each of the more special abilities listed above than each of them is correlated with each of the others, the intelligence score becomes the most representative single measure of mental development. The intelligence-test score is closely associated with success in school and obviously measures the abilities essential for school and college work. It is particularly predictive with subject matter requiring more than memory. Since general intelligence progressively increases in the child as he grows older, it is possible to compare mentally defective adults with children and so demonstrate that such adults are retarded in their mental development.

Mental age is a concept which has been developed as a measure of mental growth. The average child of a given age is able to perform certain functions, such as obeying simple commands, building certain structures from blocks after a demonstration, and interpreting pictures or telling stories about them. If a particular child can perform the crucial operations of the average eight-year-old, he is said to have a mental age of eight years, regardless of whether his chronological age is six, eight, or ten years. The *I.Q.*, or *intelligence quotient*, is the ratio between a child's mental age (M.A.) and his chronological age (C.A.). In order to avoid fractions, the ratio is multiplied by 100. The formula for determining the I.Q. thus reads:

$$\text{I.Q.} = \frac{\text{M.A.}}{\text{C.A.}} \times 100.$$

If the child mentioned above passed the eight-year-old test at the age of six, his I.Q. would be 133; if he passed it at the age of eight, his I.Q. would be 100; and if he passed it at the age of ten, his I.Q. would be 80.

The mental age of the average child continues to increase until the age of about fifteen or sixteen, so that, in using the formula for adults, the chronological age is always treated as if it were one of these figures. For example, in one well-known test, all persons of sixteen and over who passed no more than an eight-year-old test would have an M.A. of 8 and an I.Q. of 53 ($8/15 \times 100$).

By treating the mental age of the average adult as sixteen, a person tends to retain a nearly constant I.Q. throughout his first thirty years of life. It is found that retarded children grow up to be retarded adults and superior children grow up to be superior adults. After the age of twenty-five or thirty, there is a very gradual decline in mental ability, so that, by the age of seventy, the average man has an I.Q. of about 80.[1] This does not mean

[1] D. Wechsler, "Intellectual Changes with Age," *Pub. Health Rep.*, 1942, Suppl no 168, pp 43–52

that every thirty-year-old man is superior to every forty-year-old man, but rather that the average thirty-year-old is superior in intellectual potentiality to the average forty-year-old. In general, the layman tends to underestimate the mental capacity of youth. It is surprising to him to find that the Government trusts eighteen-year-olds to pilot expensive bombers and carry out bombing missions, when, only a year previously, their parents regarded them as too immature to drive the family car safely.

The decline in general intelligence and the decrease in speed and flexibility in mental functions with advancing age probably is one of the reasons why older men in industry are less adaptable to new methods than are younger men. This loss in flexibility is apparent in the older men working in the shop when they object to new-fangled methods and safety devices, and, perhaps to an even greater degree, in older executives who cannot adapt themselves to changing industrial conditions. Nevertheless, frequent exceptions are to be found, since individuals of the same age differ to such a great degree.

In considering a gradual decline in potential intelligence, it is important not to lose sight of the fact that intellectual accomplishments are not purely a matter of general intelligence. It is obvious that the adult has many intellectual superiorities over the sixteen-year-old child. These superiorities are largely the contributions of experience, and this experience is very important and must not be neglected. An inventor must have both intelligence and knowledge, and a foreman or a tool-maker improve enough through experience to counterbalance other losses due to age. The professor is still able to teach college students and to think more accurately in his specialized field than are his students, even when the I.Q.'s of some members of his class surpass his own. Social judgment, responsibility, carefulness, and perspective are important traits which improve with the experience of living.

In general, the intelligence test is most suitable for measuring children and adults who are average and below average in men-

tality. It is difficult to devise satisfactory tests for highly superior adults, since an I.Q. of 140 or over occurs in only about one per cent of the population. Superior children can always be compared with older average children, but superior adults must be studied in relationship to each other. The standard intelligence tests, therefore, are relatively inadequate for differentiating the highly superior individuals. Although these intelligence tests would show engineers and research men in industry to be highly superior, they would not be very effective in distinguishing the ingenious and creative men from the rapid learners.

The present trend in testing is toward more and more specific tests. Instead of seeking to refine further the notion of general intelligence, the interest is shifting toward determining the number of different factors which make up intelligence. When broken down in this way, the mental abilities turn out to be such functions as verbal comprehension, word fluency, number facility, memory, visualizing or space thinking, perceptual speed, induction, speed of judgment, and many others not yet isolated.[2]

By analyzing intelligence into its many elements, better selection and vocational guidance will undoubtedly be achieved. There also is a danger that something may be lost. Combinations of abilities produce relationships between them. Thus, AB is made up of A and B, plus the relationship between A and B. A house is made up of a pile of bricks, but a pile of bricks is not a house. It is possible that we may lose certain relations between abilities if we pay too much attention to the elements which are related. Will an anagram expert's performance be a mere combination of word fluency and visualization, or will the relationship between the two give him an added advantage? Will inventive ability turn out to be an elementary ability, or is it dependent upon the elements with which it is combined? These are problems with which research psychologists must concern themselves.

[2] L. L. Thurstone, "Testing Intelligence and Aptitudes," *Hygeia*, January, 1945, pp 1–8.

INDUSTRIAL USES OF INTELLIGENCE TESTS

A great variety of intelligence tests is available for industrial purposes. There are group tests, individual tests, self-administering tests, and performance tests. All are correlated with each other, but some are more applicable to particular occupational groups than are others. The various tests sample different mental abilities in different proportions; thus, some samplings fit the demands of a given occupation more closely than others.

Proficiency in most forms of office work shows relationships with intelligence-test scores, and correlations between .34 and .57 are very common. In one study, it was found that an intelligence test was more diagnostic for choosing stenographers than was a test for stenographic achievement.[3] The abilities making for proficiency of mill supervisors, public utility employees, salesgirls, and the abilities essential in a great variety of other occupations have shown significant relationships with intelligence. On the whole, jobs requiring dexterity, strength, and routine mechanical operations show no relation with intelligence. As a matter of fact, the lower levels of intelligence are sometimes more satisfactory for these jobs. In a simple assembly operation, a negative correlation was found between the amount produced and intelligence scores.[4] Later in our discussion of labor turnover, we shall see that job satisfaction is closely associated with intelligence, and that the most desirable amount of intelligence varies considerably even from one factory job to another.

MECHANICAL-RELATIONS TESTS

What is commonly called mechanical ability is really a combination of general intelligence and certain aspects of muscular co-ordination. Among the mechanical-ability tests we find some that measure primarily the mental aspect of mechanical relations,

[3] S. M. Shellow, "An Intelligence Test for Stenographers," *J. Person. Res.*, 1926, *5*, 306–308

[4] J. Tiffin, and R. J. Greenly, "Employee Selection Tests for Electrical Fixture Assemblers and Radio Assemblers," *J. Appl. Psychol*, 1939, *23*, 240–263.

whereas others measure primarily certain muscular or motor abilities. It is necessary, therefore, to distinguish between two types of tests of mechanical ability. In this section of the chapter, we are concerned with tests which measure the understanding or comprehension of mechanical relationships. For convenience, we have called them *mechanical-relations tests*. The mechanical tests which measure, to a large degree, the motor aspects of mechanical ability will be discussed in the next section.

The intelligence of some people seems to make them particularly adapted to working with machinery, whereas that of others seems to make them more adapted to dealing with literary subjects or human relations. Mechanical tests of intelligence are formulated to give more weight to the former kind of intelligence than to the latter; for this reason, these tests may be regarded as a more specific kind of intelligence test than are the tests of general intelligence. Because a great deal of industrial work is mechanical in nature, it is often desirable to use this more specific type of test of intelligence in industry.

Various kinds of mechanical-relations tests are available, some being individual and others of the group-test variety. Most of them show a rather high correlation with each other, so it may be supposed that mechanical comprehension is rather general in nature. The common form of the test is designed to determine whether a person has insight into mechanical functions. Some of the tests present pictures of pulleys or gears and the person tested must describe which way one wheel turns when another turns clockwise. Care is taken not to require mathematical computations, since the inclusion of such items would make the test a measure of achievement rather than of aptitude.

In other forms of tests, a person is required to name the functions of various parts of a machine. Such questions presuppose a general knowledge of shop machinery, but, when all people tested have a shop background, such questions really measure comprehension rather than knowledge. Still other tests require that

parts of unfamiliar mechanisms be assembled. This requires insight into the relationship of the various pieces and thus resembles a puzzle. Often the parts are blocks which have to be fitted together to produce an end product of specified shape. In the latter case past familiarity with machinery is entirely excluded as a helpful factor.

Inventive mechanical ability is tested by showing an applicant how a particular gadget functions and requiring him to draw diagrams to show how the inside mechanism must be arranged in order to work the way it does. For example, he may be shown how the movement of one lever activates another lever in a peculiar fashion and be asked to draw the inside mechanism that makes possible this peculiar action.

The selection of repairmen, trouble-shooters, and many machine operators can be greatly improved by the use of well-selected mechanical ability tests.[5] The proper test battery to use for a given job is the one that proves itself to be the most selective, although the use of any one of them would be more satisfactory than the use of none at all.

MOTOR CO-ORDINATION

DIFFERENCES BETWEEN MOTOR ABILITIES

The motor functions, such as dexterity, manipulative activity, and muscular control in general, are unrelated to the mental functions. It is not surprising, therefore, to find that a very intelligent person may be all "hands and feet" when it comes to assembling a simple piece of machinery or operating a lathe.

Though not commonly known, it is a fact that the various motor tests show little or no relationship with each other. In one study, the average correlation between a large number of motor tests was found to be only +.15.[6] Apparently, these functions are highly

[5] C. L. Shartle, "A Selection Test for Electrical Troublemen," *Person. J.*, 1932, *11*, 177–183.

[6] E. Garfiel, "The Measurement of Motor Ability," *Arch Psychol.*, 1923, *9*, no. 62, p. 32.

specific, and any given person may be endowed with almost any combination of the specific talents. Therefore, we cannot speak of men as being generally handy with their hands. A high degree of muscular co-ordination may be limited to certain parts of the body so that the co-ordination may be superior as far as the hands are concerned, and inferior with regard to finger control or to the use of the feet. The co-ordination between the use of the hands and visual experiences may be developed to a different degree from that between the use of the hands and hearing. The effectualness of the muscular control may vary for heavy and light work, for detailed and rough work, and for fast and slow work.

For these reasons, as well as others, tests of motor functions must be more carefully selected than mental tests. Since the motor abilities are highly specific, the individual tests are relatively simple, and their administration does not require a great deal of time. A good sample of the pattern of motor abilities can be obtained relatively quickly. Most of the tests involve equipment, however, and must be given individually. A few have been reduced to pencil-and-paper performance and can be given to groups. For example, such a test may require the applicants to put dots in circles arranged on a sheet of paper. In some cases the score is based on the number of circles filled out in a specified period of time.

CHARACTERISTIC MOTOR TESTS

Typical dexterity tests require the applicant to place pegs in small holes arranged in various patterns. The arrangement of the holes determines the relative importance of finger and arm movements. Precision tests may require the testee to plunge a stylus accurately into a hole each time it is mechanically uncovered. Some tests merely record the speed with which one can tap a stylus on a metal disk and activate an electrically controlled counting device. Tests of rhythm require the applicant to duplicate, by tapping a telegraph key, a pattern which is presented on a phonograph.

The use of a device which measures the speed with which a person can react to a signal is one of the oldest tests in use. This reaction time varies with the type of stimulus used and the conditions under which it is given, as well as with the person tested. Short reaction times are helpful in most activities which require alertness.

Tests of motor co-ordination are usually more elaborate than those described above. They require a person to co-ordinate different movements of the two hands or of the hands and feet. A person may be asked to cause a beam of light to follow a given course when the horizontal movement is controlled by one lever and the vertical by another lever. The arrangement of the task is unusual in that it does not duplicate learned activity. In more simple arrangements, a person may be required to turn, as rapidly as possible, a small crank with the right hand and a large one with the left hand.

When the purpose is to test aptitude, the task required is usually one that does not duplicate some form of work. In so far as a test situation simulates a kind of work, it tends to become an achievement test. In some instances motor tests are purposely designed to duplicate some of the activities required on a given job.. Such tests are achievement tests and may be used to select experienced men. They may be used for testing aptitude, however, if they are given to men with no experience or with the same amount of experience. When such tests distinguish between good and poor operators who possess the same degree of experience, they are highly satisfactory tests for aptitude.

PERSONALITY TRAITS

THE NATURE OF PERSONALITY

Contrary to popular usage, personality should not be regarded as a "something" which characterizes the inner self, such as the spirit of the individual, or as a force within man which makes him what he is. Like general intelligence, the term refers to a group of

abilities or traits. Unlike general intelligence, the traits are unrelated, so that a knowledge of some personality traits gives no clue as to the nature of other traits. For this reason, each of the specific traits which are pertinent to performance on a job must be measured separately.

The personality traits include such characteristics as honesty, cheerfulness, persistence, dominance, emotionality, adjustment to life, sociability, relation between emotion and reason, and cooperativeness. Some authors also include mental and physical characteristics among personality traits, but, when they do so, they use the term to refer to all the traits of man. This general use of the term makes it relatively meaningless. Since we have divided all the traits into four areas, our use of the word is more limited and so has a more specific meaning.

There is no question that mental and physical traits influence many personality traits, but modifications of personality arise because this group of traits is very subject to change through experience, and the mental and physical factors influence this experience.

We have already seen what frustration may do to emotional adjustments (see pages 59–69). A man of small stature is frustrated because of this inferiority, so he becomes aggressive and carries a "chip on his shoulder." Women are frustrated in business because of differential pay rates, and they become dissatisfied and are on the defensive. Many develop traits of resignation, making their adjustment in that way. Childhood insecurity, frustration arising through the excessive care given a younger brother or sister, problems of the only child, difficulties arising when one boy is dominated by several sisters, and many other family situations have an influence on personality development.

Intelligent people often have difficult emotional adjustments to make. The highly intelligent child has an easy time in school, is praised by the teacher and envied by his contemporaries, but he faces difficult adjustment problems when he enters the world. He

tends to have ideas about doing things in a better way, but his efforts are unappreciated because the boss does not like to be "shown up"; he is critical of less intelligent associates and becomes unpopular; he cannot find friends of like ability because highly intelligent people are rare; so he is lonely.[7] These and many other experiences will leave their mark, and he will make either good adjustments or highly inadequate ones. The child of low intelligence likewise has adjustments to make. Since he experiences inferiority in school and in later years, he has to make adjustments to life which fit his abilities.

In all aspects of life, it is the unusual or exceptional individual who has the difficult adjustments to make. Very often the inability to make human adjustments drives men to apply themselves exclusively to their work. Work is their escape, and the resulting application frequently results in great success in fields in which human relations are relatively unimportant.

Personality traits are also dependent on heredity and on the functional condition of our bodies. Heredity determines the potentialities of personality development, but experience can influence their course within certain limits. An accurate estimate of the limiting influence of heredity is still undetermined, however. That some people, through heredity, are more likely to become neurotic and maladjusted than others is generally agreed, but that some will remain relatively normal, no matter what their life-problems turn out to be, is a matter of debate.

The functions of the endocrine glands play an important part in man's general makeup and determine his physical and mental growth as well. For instance, inadequate functioning of the thyroid gland makes one easily tired, sluggish, and unable to concentrate, while overfunctioning of this gland results in restlessness, irritability, and worry. Extreme malfunctions of this gland produce marked bodily symptoms and interfere with both mental and

[7] L. S. Hollingworth, *Children Above 180 I.Q. Stanford-Binet*, pp 258–262 and 271–283.

physical growth. The parathyroid glands have a quieting function, so that excessive secretions produce lassitude, while deficient amounts induce overexcitement.

In general, the glands regulate the chemistry of the body, and a proper balance in their function is essential if man is to have the personality traits which are normal for him. There is no reason to believe that one can control personality by the injection of glandular secretion. Rather, certain maladjustments are due to glandular unbalance which can be corrected by medical treatment.

Other bodily conditions also influence our reactions. Hungry or tired people are more irritable and more likely to be uncooperative. Well-fed and rested men are more generous and congenial. After-dinner stories are invariably funny.

THE MEASUREMENT OF PERSONALITY TRAITS

The methods of measuring personality traits fall into three types: the experimental method, the rating procedure, and the questionnaire form. Each one has its limitations for industrial use, but a discussion of them is worth while both because it adds to an understanding of problems involved and because it indicates the conditions under which the methods are invalid. Short-cut methods, such as an analysis of photographs, handwriting, or any physical characteristics, are entirely unsound and have been completely discredited by research.

The experimental method measures the individual reactions to specifically arranged test situations. For example, honesty has been measured by determining whether children will record all of their errors when grading their own examinations.[8] If the grading is done the day after examination, under the pretext of helping the teacher, the child does not suspect that a previous record has been obtained, and the test becomes a realistic situation. This duplication of a real-life situation is highly desirable, since certain person-

[8] H. Hartshorne, and M. A. May, *Studies in Deceit*, Part I of *Studies in the Nature of Character*, pp. 51 f.

ality traits, at least, vary greatly with the type of situation. Attempts to measure persistence have led to the creation of situations requiring the endurance of pain and the continued attempts to solve difficult problems. At the present time, this approach has been used largely to explore the nature of personality traits and to determine the conditions which influence the expression of various traits. Its practical use as a method for objective measurement of specified personality traits must await further developments.

In industrial studies this procedure has been limited primarily to the study of emotional reactions. The lie-detector is an instrument which accurately records the extent of some of the emotional reactions to certain stimuli; it does not indicate the kind of emotion. Other tests of emotionality involve a situation in which the applicant is put to work on some motor-co-ordination test and then is suddenly frightened by having the floor drop from under him or is confronted with flashes of light or loud noises. How the individual reacts under such conditions is a measure of his fright reaction. By measuring the emotional behavior under conditions of stress, one can detect individuals who are easily upset by noise, danger, and pressure of work. Since some individuals completely lose their skill and judgment under emotional stress, tests of emotion are highly desirable for occupations in which this behavior is detrimental. As will be seen in the discussion of accidents, tests of emotionality can be used to good advantage in reducing accident rates.

If this method were adapted to the measurement of other personality traits, one would set up a series of situations which simulated actual work conditions, and determine the number of situations which produced a given kind of behavior. For example, to measure the trait of determination, one would create a series of trying conditions and see in which a given person will give up. In essence, the German Army used this procedure in selecting officers. The soldier was put through a very strenuous series of activities, some of which were humanly impossible, to determine under what

conditions his spirit would break. Of course, one might still be in doubt as to whether such tests measured blind persistence, fear, high motivation, or self-confidence, rather than determination. The period of officer-training in this country allows opportunity for instructors to rate the personality makeup, so that, in a sense, the experimental method is combined with rating procedures.

The psychological examiner frequently observes many personality traits when individually testing for other abilities. He can observe co-operative behavior, persistence, poise, and tendencies to make excuses. Although such observations are not standardized, the experienced tester soon learns to use them to advantage. The skilled interviewer also can make pertinent personality observations, a source of supplementary information which should not be overlooked.

The rating method utilizes other people's estimates of a given man's personality traits. The procedure has already been described in our discussion of rating proficiency on a job. By using a list of pertinent personality traits, a group of people can rate any given individual who is known to them. Since, unfortunately, prospective employees cannot always be rated, this method is largely limited to the function of placing more effectively men already employed. In some instances recommendation forms are so arranged that an applicant must be rated by the persons who recommend him. When this is done, it is desirable that the same persons recommend several employees, for, in this way, the raters are required to make comparisons. When hiring young men from trade schools, such data can be furnished by teachers who are in a position to rate several prospective workers.

The great virtue of the rating procedure lies in the fact that a wide range of traits can be explored with a very little time and effort. The method presupposes, of course, that the employer already has determined the traits which best suit specific jobs. The limitations of the rating method which were discussed in Chapter 7 apply also in the rating of personality traits.

The questionnaire method of testing personality has been used very widely, largely because it is simple to administer. The applicant is required to fill in a form by answering a series of questions, usually with "yes" or "no." From the responses, some understanding of the person is achieved. Widely used questionnaires are concerned with measures of emotional adjustment and tendencies toward introversion or extroversion. Since emotional adjustment is very essential to co-operative behavior and morale, these questionnaires or scales are often useful in detecting problem employees.

Poorly adjusted people tend to exaggerate their troubles, so that their behavior is not in keeping with the situation. They feel they are unlucky, excessively criticized, lonely, and misunderstood. They have no confidence in other people, do not enjoy the company of others, and have family conflicts. In general, their health is poor, they have no appetite and they sleep poorly. It can readily be seen that selected questions would have diagnostic value in detecting poor adjustment.

It is obvious, however, that the answers are of value only when they are honestly given. For this reason the questions are made as innocuous as possible and the test is called a personality inventory or a temperament scale. Nevertheless, these precautions have been found to be somewhat inadequate. In one experiment,[9] students were asked to fill out a questionnaire that was designed primarily for detecting poorly adjusted individuals in industry.[10] The students were first asked to answer the questions honestly, and then to answer them again under the assumption that they were applying for a job. It was found that, under the second condition, there were more answers of the good-adjustment type than under the condition which favored honest answers. It is apparent, therefore, that a person applying for a job can give a favorable

[9] The study was made by W. J. Giese, and F. C. Christy, and is reported by Tiffin in *Industrial Psychology*, pp 117–118

[10] D. G Humm, and G. W Wadsworth, *The Humm-Wadsworth Temperament Scale*, 1940 Revision, Los Angeles, Calif.: D. G. Humm Personnel Service.

slant to his responses. Such tests may be regarded as having their greatest value only when employment does not depend upon the response.

The questionnaires are most adequate when used with the personnel already employed, in which case they can be used to achieve better placement. Some positions involve very little contact with other workers and satisfactory adjustments can frequently be made. A good personnel department could serve also in a therapeutic capacity, lending valuable aid to maladjusted employees. Since very capable men are often badly adjusted, such a service would frequently prove a sound investment. Despite the disadvantages mentioned above, the use of the questionnaire with prospective employees has proved very valuable in reducing the number of persons discharged for personality maladjustments.

Recently, a new group of questionnaires has been made available.[11] These scales are designed to measure rather specific personality traits. Thus, (1) shyness; (2) cycloid trait (easy and frequent changes in mood); (3) ascendancy (as opposed to submission in social situations); (4) depression (lonely, low spirits, worries over possible misfortunes); (5) rhathymia (care-freeness); (6) nervousness (easily disturbed, inability to relax, nervous manner); (7) general drive (quick in action, rushes into work); (8) meditative thinking (analyzes others, serious, philosophic); (9) masculinity (as opposed to femininity in attitudes and interests); and (10) lack of inferiority are among the traits isolated. The scales are based upon research which led to the isolation of primary traits, as distinct from compound traits. Such traits as persistence and honesty have been found to be compound rather than unitary. For example, persistence in enduring pain is quite different from plodding or keeping at a task. Likewise, honesty may vary greatly from one situation to another, so that we may speak of

[11] (a) *The Guilford-Martin Inventory of Factors G A M I N;* (b) *The Guilford-Martin Personnel Inventory;* (c) *The Guilford-Martin Temperament Profile Chart;* (d) *Guilford's Inventory of Factors S T D C R;* Beverly Hills, California: Sheridan Supply Company, 1943.

different kinds of honesty. It is quite possible that the isolation of primary personality traits will lead to much greater refinement in personality measurement.

OCCUPATIONAL DIFFERENCES IN PERSONALITY

Emotional adjustment is an aspect of personality which influences the value of a person on almost any kind of job. Nevertheless, it must be recognized that it is more essential for some kinds of work than for others. Similarly, other personality traits are conducive to success in some occupations and play relatively unimportant parts in others. Certain occupations may, therefore, be expected to attract individuals of special personality makeup. Investigations reveal that the personalities of people engaged in the various occupations do not follow a chance distribution, but show marked differences in their trends. For example, a comparison of department-store salesgirls with clerical workers revealed that the former were above average in nervous stability, self-sufficiency, extroverted tendencies, and dominance, whereas the latter were below average in these personality traits.[12]

Actual success of salesmen has been found to be more closely related to personality traits than to either mental traits or business knowledge.[13] The recognition of the importance of certain personality traits should lead to improved selection in many occupations. An example of the use of personality tests was demonstrated in an experiment in which their utilization was found to be useful in selecting applicants for sales positions.[14]

Success in foremanship has also been shown to be related to personality. In one study, the foremen were divided into two groups according to whether they were successful or unsuccessful supervisors.[15] Care was taken to see that the two groups were

[12] M. R Trabue, "Occupational Ability Patterns," *Person J.*, 1933, *11*, 344–351.

[13] R. F. Lovett, and M. W. Richardson, "Selecting Sales Personnel," *Person. J.*, 1934, *12*, 248–253.

[14] N. L. Hoopingarner, *Personality and Business Ability Analysis.*

[15] C. L. Shartle, "A Clinical Approach to Foremanship," *Person. J.*, 1934, *13*, 135–139.

matched in skill and knowledge. It was found that the unsuccessful group tended (1) to withdraw from others; (2) to be indifferent to the actions of people; and (3) to show antagonism in their dealings with people.

Although research along these lines has not progressed to a sufficient degree to warrant the drawing of far-reaching conclusions, it is apparent that certain patterns of personality are more suited to one occupation than to another. The problem is to identify the crucial traits and devise simple tests for detecting them.

THE MEASUREMENT OF VOCATIONAL INTEREST

An approach which may throw considerable light on occupational differences in personality is the measurement of interest. To be an ace in war combat requires certain personality traits as well as intelligence and skill. It has been observed that athletes who chose such sports as football, wrestling, boxing, and hockey in college are more likely to have the desired personality makeup for aerial combat than those who chose such sports as track, baseball, and tennis. The interest in firsthand contact with the opponent seems to be a basis for the sport chosen, and the personality traits leading to this interest are related to success in air warfare.

Interests are largely a matter of personality and can readily be measured by means of interest questionnaires. Some men would rather work indoors than outdoors; some like to deal with people, others prefer working with machinery; some crave responsibility, others strive to avoid it. By matching interests and vocations, it is quite apparent that job satisfaction, at least, can be increased.

The question as to whether a man is more proficient in work which lies along his interests than in work which does not has not yet been settled. Certainly, there is no evidence of a general tendency for a man to be less proficient in his preferred occupation than in disliked occupations, so that no loss in efficiency would result in using interest questionnaires. Ordinarily, a man loses

interest in things he cannot do well, but some persist in proving to themselves that they can master anything they try. Others never discover that their work is actually of inferior quality. On the other hand, some men are highly proficient in work that they dislike, and it is a question whether they should change their occupation and learn another.

At the present time the use of interest scales has been confined largely to vocational guidance. Their wide use in this field would prevent many misfits, thus making their adoption in industry less necessary, since only interested people would apply for a given job. However, as long as economic conditions periodically force individuals to take whatever occupation is available, it is important that industry consider interests as a subject with which it will have to reckon.

THE MEASUREMENT OF PHYSICAL AND SENSORY CAPACITIES

VARIATIONS IN BODY STRUCTURE AND THEIR IMPORTANCE

Some occupations require rather special physical structures. For certain kinds of heavy work, a strong, stocky build is desirable. One illustration of this is given in the following chapter in connection with the selection of pig-iron handlers. In other cases, a wiry build is preferred, such as in jobs which require a great deal of walking or running. Small, rather than large, hands may be an advantage in fine assembly work. Although the relation of body build to occupational proficiency has not been explored to any great extent, employment managers react to such factors in their selection of men. The validity of their opinions, however, should be determined in order that the correct aspects of body structure may be considered in selection.

Various sports definitely differentiate between men of different structure. Thus, football, basketball, cross-country running, the hundred-yard dash, and long-distance swimming are aided by certain bodily structures and proportions. These aspects of body build often determine whether or not a student will make the var-

sity team. There is every reason to believe that proficiency in different occupations may be similarly related to certain bodily structures.

Body structures can easily be measured by a set of scales and a tape measure. Various proportions, such as the relation between weight and height, length of trunk and legs, length and width of hand, and total height and width of shoulders, should also be considered. The strength of various muscle groups can also be determined with simple measuring devices. Since strength varies for different parts of the body, strength of hands, arms, legs, and back must be differentiated. The relation of strength to body weight is also important, particularly in occupations involving much walking and climbing.

THE SIGNIFICANCE OF SENSORY DIFFERENCES

The measurement of sensory acuity has special importance in certain occupations. Tactual sensitivity is important in such occupations as lens-grinding. Auditory acuity is undoubtedly important for garage mechanics and other occupations requiring the identification of small differences in sound. For fine skills, muscular sensitivity plays an important rôle, since it is necessary to recognize movements by the way they feel.

The most important sense is perhaps that of vision.[16] Not only is it necessary to determine visual capacity in general, but how well the vision is adapted to the job in particular. Thus, for close work persons who tend to focus their eyes relatively close produce significantly more than those who tend to focus farther away. The use of glasses which adapt the eye to the special work resulted in increased production in hosiery-loopers.

In one investigation of textile workers, nine out of fifteen different visual tests were found to be related to successful inspection of cones of rayon yarn.[17] It was found that 35.6 per cent of the in-

[16] For a detailed treatment see J. Tiffin, *Industrial Psychology*, chap VI.

[17] A W. Ayers, "A Comparison of Certain Visual Factors with the Efficiency of Textile Inspectors," *J. Appl Psychol.*, 1942, *26*, 812–827.

spectors failed three or more of these tests, and only 6.7 per cent of these were found to be above average standard in job performance.

Many operations also require accurate judgments of distance. Since distance perception is largely a matter of vision in the two eyes, it can be accurately measured. Many accidents in industry are caused by faulty vision and can therefore be prevented. Hiring men who do not wear glasses does not protect the employer against men with defective vision. Since the man with glasses has at least had his vision tested, he may actually be a safer risk.

Since night and day vision depend upon different types of cells in the eyes, it goes without saying that people who are alike in day vision may be highly unlike with respect to night vision. Work which requires vision under dim illumination must, therefore, take this fact into account. Bus- and truck-drivers who have accidents primarily at night are probably defective in night vision.

Color vision varies greatly among men, and color-vision tests are necessary to detect this deficiency. Many partially and totally color-blind people are unaware of the defect. For jobs which require color differentiation, careful testing is highly essential in the selection of personnel.

Vision also varies with age, and many people fail to recognize the gradual reduction in ability to see at close range. Glasses can correct these changes, but the only way to be certain that the employees are obtaining these corrections is to have periodic examinations made at the plant.

THE SIGNIFICANCE OF DIFFERENCES IN PERCEPTION

Visual perception is dependent on the way the brain organizes the nervous impulses which come from the eyes. The importance of this organizing function was illustrated in Figures 1 and 2 (pages 28 and 39), which showed that the same visual object could be seen quite differently with the same eyes. Whether or not one will see a particular part of a complex object is, therefore, a matter

of perception as well as one of visual acuity. Even more common differences in perception arise when a picture contains many objects. Which details will be seen depends on the way the elements are grouped, what the subject is looking for, and the like. Asking people to tell what they see in an ink blot brings out a great variety of reactions. Experiments on perception have shown that the eye may report a detail as perfectly as does a film, but the detail may fail to be experienced by the observer. Two observers of the same picture will describe widely different versions of its details. Whether or not a person will notice defects in inspection work, see the conditions leading up to an accident in time to prevent it, or detect the snapping of a thread in weaving, depends upon his perception as well as upon his vision.

People differ greatly also in the rapidity with which they perceive. A brief exposure will permit some men to identify the make and model of a plane, whereas others do not have time even to recognize the object as a plane. Fast readers are usually rapid perceivers because they can recognize words by rapidly scanning from one to the next. Slow perceivers are handicapped in situations in which only a momentary glance at an object is available. This is invariably the case when objects are in motion, and motion is a common factor in industrial work.

Another aspect of perception which is important in many industrial operations is the size of the visual field. For example, some automobile-drivers see only the street, while others see the houses along the street as well. In tests in which the exposure to the visual object is too brief to permit eye movement, some people recognize detail far off to the side of their point of fixation, whereas others can see detail only at the point at which they are looking. It is apparent that work which involves a large field of vision will be ill-adapted to a person with a small perceptual field, even though his visual acuity may be highly adequate.

Perception is partly a matter of training, but primarily the difference in people is an inherent one which cannot be eliminated

by experience. To the extent that the differences are hereditary, industry must solve the problems by employee selection. Training will influence the kind of detail that will be seen, but it cannot correct basic differences in perceptual speed and in the size of the visual field. A person trained in the Chinese language will see details in a Chinese character that others will miss, because his familiarity with the characters makes him react to details which are necessary for reading. For the same reason, a man trained in a given job can be made responsive to the kind of defect which he is set to perceive. Speed of perception can be improved by training only in so far as it teaches people to see groupings of objects rather than individual objects. Thus, a person can speed up his reading by learning to react to groups of words rather than to single words. Even after training, however, people differ widely in their manner of perceiving.

Methods for measuring the various phases of perception are available, although the proper norms for various industrial jobs have not yet been established. Future testing programs will undoubtedly give more and more attention to this important application of psychology to industry. In the meantime, we must be aware of the differences between people so that we can distinguish between a person who does not try and one who cannot do certain things.

RELATION BETWEEN TESTS AND JOB ANALYSIS

The discussion of psychological tests in relation to jobs has revealed that a great variety of abilities are essential to efficient performance even on relatively simple jobs. The differentiating of the abilities pertinent to different kinds of work is one method of analyzing a job. The goal of such an analysis is to locate people whose abilities best fit the job. The testing program used by the Army has clearly demonstrated that there have been many occupational misfits in the past.[18] In assigning men in the Army to

[18] W V. Bingham, with J. Rorty, "How the Army Sorts Its Manpower," *Harper's Magazine*. 1942, *185*, 432–440.

work which is best suited to their abilities, many striking cases of unusual proficiency have been uncovered. Men who, in civilian life, have been unhappy, badly adjusted, and devoid of interest in the affairs of life, have found their Army work highly satisfying, both intellectually and emotionally. It is obvious that a man's free choice in his life-work is not necessarily a wise choice. Hidden abilities and talents remain dormant unless some situation brings them to expression. It is this rôle of uncovering hidden talent that a well-rounded battery of tests may perform.

The potentialities of an adequate testing program are being only sampled at the present time. The large amount of data accumulated by the Army will undoubtedly serve eventually to advance the use of tests for industrial purposes. Research which uses the factory as a laboratory and the workers as subjects must, however, give the final answers. It is hoped that the future will see industry not only co-operating in such research programs, but actively encouraging and supporting them.

10 MOTION AND TIME ANALYSIS

INTRODUCTION

The two preceding chapters dealt with the problem of analyzing jobs in terms of human abilities. By the selection of individuals who possess the abilities most essential to a given job, productivity on that job is increased without driving men to expend more energy than formerly. A person who is unadapted to a job uses a good deal of his energy for unproductive purposes and receives none of the satisfactions associated with proficiency.

In the present chapter the problem of job analysis will be approached from the other side. The question will be, How can a job be altered so that it will better fit the nature of man's abilities? Men differ only in the degree to which they possess abilities, hence they have very much in common. Certain kinds of activity are unnatural for the way a man is constructed. Any change in a task which makes it better fit the human organism should increase the productivity of all men. The motion-and-time-study approach, then, is to fit jobs to men rather than men to jobs. Therefore, we shall now discuss men from the point of view of the ways in which they are alike rather than of the ways in which they are different.

True motion and time methods should likewise increase production without increasing the human energy expended. In this way it differs from the "speed-up," which attempts to increase production by increasing the energy output. Failure to differentiate be-

tween these two procedures is to miss entirely the importance of the contribution which motion and time analysis can make to modern industry.

In general, time and motion analysis is looked upon with disfavor by the labor unions. In the early days it was practiced by "efficiency experts" who sold their plans to industry by promising them larger profits. Too little consideration was given to labor's reactions and interests, so the plan paid dividends both in money and labor unrest. Labor found that efficiency made for insecurity in the worker's positions, since the increased production by the new methods did not result in a proportional increase in demand for further production. Men were dismissed and, frequently, never again obtained permanent employment.

It is now clear that a plan which will be efficient in the long run must benefit all society. There is no reason why increased production should not do this. Opposition to motion and time study, therefore, does not constitute an argument against it, but rather against the way it has been used.

THE GENERAL NATURE OF MOTION AND TIME STUDY

It is apparent that some jobs require a combination of activities which do not necessarily go together in the makeup of man. For example, positions that demanded both research and administrative abilities might be very hard to fill. If, however, the duties of such a position were divided, then the resulting research and administrative positions could each be filled by specialists. Similarly, the breaking-down of mechanical jobs in a factory permits more specialized abilities to be utilized. This breaking-up of jobs into smaller and specific units, so that each man performs more simple and routine operations, is characteristic of the modern production method.

Another function of motion and time study is to determine the most efficient way to execute a given operation. A man left to his own devices is not very likely to perform a manual operation in

the most effective manner, no matter how much he practices. We need only compare the skills of a boy who learns to swim by himself with one who is aided by a coach to appreciate the importance of superior methods. If a well-trained coach can improve efficiency in a sport by teaching the most efficient strokes, it goes without saying that proper guidance will improve skill on a job. Girls who had no knowledge of the proper use of a typewriter would learn the "hunt-and-peck" system rather than the "touch" system; once having learned it, they would resist changing to the superior method. The way a person performs a task has a great effect on the final efficiency which he will attain, and this final efficiency may be quite independent of his actual manipulative ability.[1]

An analysis of an inspection job revealed that most workers tended to put their attention on the wrong aspect of an operation.[2] In visually examining tin-plates for defects, the natural tendency for inspectors was to watch what they were doing; as a result, they watched the plate they were handling, which was naturally in motion. This misplaced attention interfered with proper inspection, because it was difficult to see defects while the plate was moving. Altering the operation so that the plate inspected was not the one in motion greatly improved the efficiency of inspectors. Although many industrial operations have already been carefully studied, much can still be learned. The illustration given above shows the need for continued search for better ways of doing a job. As simple a thing as the part of the operation on which the worker places his attention may greatly alter the level of difficulty of a particular job. Such a deficiency in procedure may readily escape a supervisor's observation.

Motion and time analysis is the name given to the process of finding better methods for doing a given job. In the earlier studies

[1] R. H. Seashore, "Work Methods: An Often Neglected Factor Underlying Individual Differences," *Psychol. Rev*, 1939, *46*, 123–141.

[2] J. Tiffin, and H. B. Rogers, "The Selection and Training of Inspectors," *Personnel*, 1941, *18*, 14–31.

the job was merely broken up and the various operations timed. It soon became apparent that both time and motion were integral parts of each job, so it became necessary to treat them together in any complete analysis.

MOTION ANALYSIS

Motion study involves an analysis of occupational movements and attempts to determine if the same results can be achieved by fewer or more simple movements. Frequently, the actions of the most highly skilled operators are photographed from various angles so that these may be studied.[3] It is assumed that the best operators probably use more adaptive movements or have discovered short cuts. By building wire models which can be manipulated to show the best combinations of movements, the process can be demonstrated and thus taught to others. Often, the actual patterns of movements are unknown to the skilled workman, so that he cannot slow them down or show them to someone else. He knows how to perform the movements, but he does not know how they look.

Motion analysis thus amounts to breaking down the activity and then seeing if the essential parts can be reassembled more simply. Unnecessary elements are dropped out, and jerky movements are replaced by smooth ones whenever possible.

TIME STUDY

The analysis of movements associated with a job may be accompanied with measurement of the time spent in the various activities that are required. Time study thus reveals how the operations are distributed. The time spent in waiting for a machine to finish an operation may be utilized if the sequence of the activities is changed. Likewise, the work of several men may be co-ordinated in a better manner if the timing is improved. If

[3] For a discussion of this method, developed by Gilbreth, see A. Ford, *A Scientific Approach to Labor Problems*, pp. 68–70.

time is lost by changing from one operation to another, the job may be divided so that one person supplies the raw material and others confine their activities to operating machines. Frequently, it is found effective to group men into teams and distribute their activities in such a manner that both timing and movements are greatly improved.

THE USE OF SPECIAL MACHINERY

Associated with motion-and-time-study work is the use of special machinery designed to simplify the work. Drills suspended from springs and within easy reach, special wrenches and screwdrivers, and all manner of other gadgets and conveniences suggest themselves when the job is subjected to analysis. A detailed illustration of devices suggested by motion analysis is given on page 196 f.

TOOL ARRANGEMENT

One of the early contributions to time and motion study was the elimination of waste effort in finding tools. By rearranging the work space and having a convenient place for every tool used, the job was often greatly simplified. Each tool was given a special place within easy reach, the most frequently used tools being most conveniently located.

Proper tool arrangement makes it possible for the worker to develop automatic habits, because the same movement is always made in obtaining a particular tool. The mere need of a tool calls up the special movement, so that, without thought on the part of the worker, the proper reach is made. Considerable time is saved by eliminating the time wasted in finding misplaced tools.

Time and effort in reaching for tools is also decreased if all operations with a given tool are carried out before the next tool is used. For example, if a large number of bolts are to be used to fasten two pieces of metal together, the naïve procedure is to drill the hole and secure each bolt separately, thus completing all opera-

tions with one bolt before going on to the next. The more efficient method, however, would be to mark all drill holes; then drill all the holes; next put in the bolts and fasten the nuts by hand; and, finally, tighten all of the nuts with a tool. If this procedure resulted in errors because the parts to be bolted tended to slip, it would be necessary merely to arrange clamps, or to have a special work space which prevented slippage. The procedure of reducing the number of times tools are changed is one of the simplest and most common methods of eliminating waste motions.

SOME CLASSICAL ILLUSTRATIONS OF IMPROVED WORK METHODS

Taylor was one of the first men to appreciate the potential benefits of scientific management.[4] Although his aim was to improve the status of labor and society in general, his general principles have not always been followed. The desire for immediate gains thus prevented the long-range point of view from being effective.

The first application of Taylor's principle was made in the Bethlehem Steel Company, on a pig-iron handling job. The pig iron had to be carried and loaded into a railroad car. Taylor carefully studied the pattern of work of the men and decided that a first-class workman should be able to handle forty-seven tons rather than twelve and one-half tons per day. His analysis led to four basic changes in method: (1) selecting only husky men for the job; (2) motivating these men with higher pay, provided they would learn the new way; (3) stereotyping the work method; and (4) distributing the expenditure of energy by the use of rest periods.

The application of the new method increased production more than three times, while the pay of those employed was increased about 60 per cent. As a result, the cost of pig-iron handling dropped radically and the men employed did the work previously done by three times their number.

The use of proper shovels for each kind of material, proper

[4] F. W. Taylor, *The Principles of Scientific Management.*

selection of men, and more efficient work habits produced similar results with shovelers. The cost of handling material dropped from seven to three cents per ton, while production per man rose 370 per cent, and pay increased 63 per cent.

From studies of this sort, one cannot determine the relative benefits accruing from each of the changes made, but it is apparent that job study can greatly alter the rate of production.

Another important name associated with motion study is that of Gilbreth.[5] Frank and Lillian Gilbreth were husband and wife and together they revolutionized the work of a good many occupations. Gilbreth had learned the trade of bricklaying, an occupation which had been passed from one generation to the next with little alteration. He found that eighteen separate movements were made in laying each brick.[6] By reorganizing the work pattern, he was able to reduce the movements to five and increase a bricklayer's production from 120 to 350 bricks per hour.

His method, in this case, involved a careful study of the position of the workman's body in relation to the wall, as well as of the accessibility of the mortar and bricks to him. He found that the workman was frequently required to work at different levels and that he had to stoop constantly in order to reach his materials. As a result of his observations, scaffolding was designed which could easily be moved up in small stages as the wall grew in height. This scaffold contained two tables, on which the mortar and bricks were arranged. The tables were placed so that the materials were within easy reach of the bricklayer. These arrangements completely eliminated stooping, which is energy-consuming but unproductive. By having a deep mortar box on one side and bricks on the other, the tradesman was trained to use both hands simultaneously in securing mortar and brick and then in bringing them together. A common laborer was assigned the job of sorting and supplying the bricks and mortar. It was a part

[5] F. B. Gilbreth, and L. M. Gilbreth, *Fatigue Study*.
[6] F. B. Gilbreth, *Motion Study*, pp. 88–89.

of the helper's job also to arrange the bricks on a frame in neat piles and place them, with their best edges up, at the proper place on the scaffolding. The bricklayer thus was saved the time of disengaging each brick from its pile and examining it for the best edge before laying it. By making mortar of the right consistency, it was possible to embed the brick properly with a pressure of the hand and so eliminate tapping with the trowel. The entire pattern of activity was greatly altered and made easier by the elimination of unproductive and energy-consuming activity. Simple aspects of the work were transferred to the helper, while the utilization of labor-saving equipment gave the bricklayer a comfortable level at which to work.

The Gilbreths not only experimented with reorganizing jobs, but also introduced methods for measuring production and motivating the worker. They fully appreciated the existence of psychological problems in connection with work methods because Mrs. Gilbreth was a trained psychologist.

As a final illustration of motion and time study, the contribution of Stakhanov to coal production may be cited. He was a miner in Russia at the time when work in the coal industry was lagging behind in the five-year plan. It was his impression that work was impeded because: (1) too narrow a face was worked; (2) time was lost because of a delay between the time of removing mined coal and putting up props; and (3) there was a lack of cooperation between cutters, removers, and proppers. Stakhanov was given the opportunity to reorganize the pattern of work so that each man had a larger cutting-face and did not interfere with the work of others. Cutting, propping, and removing coal became orderly and integrated activities.

As a result of the reorganized work pattern, Stakhanov found that his own production immediately rose from 8 tons to 70 tons in a seven-hour day; later, it rose to 102 tons. The new method became a kind of industrial movement which spread to other groups of miners, and similar increases in production were ob-

tained. Wages rose from 560 to 1600 rubles per month. Because of the startling results, as well as the need for coal, Stakhanov became a national hero; his methods, known as Stakhanovism, influenced the organization of work methods throughout the Soviet Union. Wherever it was introduced, Stakhanovism resulted in increased production.[7]

THE MOTION-AND-TIME-STUDY ENGINEER

It has already been pointed out that labor is very unreceptive to changes in the job layout. For this reason, the motion-and-time-study engineer must be very tactful, as well as sympathetic, with labor representatives. The desired changes should and can be made in good faith and, if the purposes are explained, labor's co-operation can be obtained. By introducing changes with the backing of labor leaders, it is possible to gain the active support of the workingman. No mentally healthy man is satisfied with seeing a job done inefficiently. Rather, men take pride in their work and are glad to help in improving methods, if they are given proper consideration and credit for their part in it. On the other hand, if the benefits are one-sided and result in insecurity for them, or if the job is changed in a high-handed manner, then labor's objection must be expected. To allay suspicion, proper guarantees must be made and respected.

Time and motion analysis allows opportunity for a great degree of creative talent. No special training will substitute for the requirement of originality. Since each job presents its own unique problem, each must be treated differently. A man who respects custom and is conservative in his thinking is not capable of seeing new possibilities. Seeing a thing done in a certain way over a long period of time gives a mental set which many persons cannot overcome. The hesitation of the general public in accepting a radically new automobile design serves to illustrate how people, on the whole, are governed by mental sets developed by past experience.

[7] R. M. MacGregor, "The Stakhanov Movement," *New Republic*, 1936, *86*, 67–68.

The old seems good and practical, while the new is risky and idealistic. Man defends his inability to adjust readily to changes by applying to the innovations such adjectives as "impractical" and "idealistic." New avenues of thinking are blocked by habit, so that many people can do little more than patch up or add to the old. Introducing changes, therefore, requires a program which prepares the minds of people for change, but, before the changes can be made, they must exist in the minds of creative individuals.

The motion-and-time-study engineer must assume that every job can be done differently from the ground up. He should be unwilling to accept the notion that, because a thing has been done a certain way for a long time, it must be the right way. He should not be a respecter of tradition, but rather a respecter of the new. Such is the nature of the creative mind.[8]

That a man has originality does not necessarily mean he is wasteful and impractical, but he should be required to experiment and test his notions before they are put into large-scale practice. The possible savings are sufficiently great to support a good research program, with workmen made available to him for experimentation.

The motion-and-time-study engineer need not work entirely from trial and error, since there are certain general principles which will serve him as guides. He should have a thorough knowledge of these principles, as well as some background in the psychology of learning, particularly in the acquisition of skill.

It also goes without saying that he must have a knowledge of and aptitude for, mechanics. Since most of the men in this work are taken from the engineering ranks, this prerequisite is usually possessed. What most motion-and-time-study engineers lack is an appreciation of the implications of their work to management-labor relations.

[8] N. R. F. Maier, "An Aspect of Human Reasoning," *Brit. J. Psychol.*, 1933, *24*, 144–145; also "The Behavior Mechanisms Concerned with Problem Solving," *Psychol. Rev.*, 1940, *47*, 43–58.

GENERAL PRINCIPLES

The way in which a man is constructed makes it possible for him to perform certain patterns of action more easily than others. His learning, attention, and interests also follow definite principles. Although motion analysis may vary from job to job, many of the general principles upon which the analysis is based remain very much the same. In the next chapter some of the more complex problems in skill are discussed. The factors discussed below are those which characterize the more standard type of motion analysis.

SEATING

That energy is consumed in standing is so obvious that it should require no discussion. Nevertheless, many industries make little or no attempt to seat men, even when this can be easily arranged without interfering with the work. Some supposedly efficient factories actually require workers to stand even while doing clerical work. Being seated, the superiors believe, is bad for discipline and encourages loafing. Such employers require men to stoop and crouch in places where sitting would be a natural and convenient position. That a prop placed under a man will make the energy saved available for productive purposes does not seem to occur to them. They make work as unpleasant as possible and then criticize men for not liking to work.

Jobs should be planned to permit seating. By means of especially constructed chairs (on wheels, if necessary) and carefully designed workbenches, many occupations would allow the seating of the worker.[9] His chair should be comfortable and adjustable so that his posture can easily be changed. If as much research were used to find comfortable chairs for workers as is used for making automobile seats comfortable for motorists, the returns in production and improved employee attitude would be highly significant.

[9] Gilbreth and Gilbreth, *op. cit.*, pp. 104–108.

POSTURE

The working posture is another obvious, but frequently overlooked, factor. Such a simple change as raising the kitchen sink to make dishwashing easier required many years for its accomplishment. The mental set of having a washpan placed on low tables carried over to having sinks at table level. In industry, many benches are still at inconvenient heights and do not have adjustments which allow short and tall men to be equally comfortable.

The balance of the body should also be considered and adjustments made to permit a man to stand at the correct distance from the work space. Arm rests frequently can be so arranged that freedom of movement is not interfered with. Stools of proper height will make it possible for a man either to stand or to sit and still have a convenient angle for work.

TOOL ARRANGEMENT AND MACHINE DESIGN

The importance of tool arrangement has already been discussed (page 194). It is now mentioned in connection with posture and seating because these factors also should be considered in arranging tools. Even long reaches for light tools and short reaches for heavy tools interfere with body balance. Overhead arrangements and brackets may solve some of these difficulties.

What has already been said about tool arrangement applies also to the operation of a machine. This being the case, machine design is a time-and-motion problem as well as an engineering one. The construction of a machine should be such that its operation becomes as simple and natural as possible. The machine is man's tool, not a substitute for man; as such, it must fit his nature as well as that of the job. The machine-designer should think not only of what the machine must do, but of how it must be operated.

Psychological faults in a number of common machines have been described, and it is apparent that engineers must work with psychologists in building machinery for a scientifically managed

industry.[10] An illustration of the nature of some of these faults appears below in connection with the discussion of the operation of the typewriter.

SYMMETRICAL AND INTEGRATED MOVEMENTS

The right and left halves of man's body are mirror images of each other. This means that movements of the two hands or arms are most simple when they are symmetrical. Thus, a movement to the right with the right hand and a movement to the left with the left hand are very naturally made simultaneously. At the same time, a pair of such movements does not disturb balance, whereas either one alone does. Time-and-motion engineers capitalize on this fact by using paired movements whenever possible. For example, a supply of bolts on the right and a supply of nuts on the left will make their assembly a symmetrical pattern.

Since both sides of the body may be simultaneously utilized, jobs should be so arranged as to permit team work between the hands. Tool arrangement and machine design can be very helpful in this. A study of the typewriter keyboard will reveal how the activities of the two hands have been considered in its layout. It will also be noted that the stronger fingers do the larger share of the work, and that the activities are well distributed between the fingers of the two hands.

Even this carefully planned machine is defective, however, from the point of view of the psychologist. In actual typing situations, it is found that the stronger or more skilled right hand does only 43 per cent of the work, whereas the less efficient left hand must do 57 per cent of the work.[11] Considering the efficiency of the fingers, it is found that the present keyboard gives the first finger of the right hand too much work and the second finger too little work. In contrast, the second finger of the left hand is overworked. The typewriter is also deficient in that it does not suffi-

[10] L. A. Legros, and H. C. Weston, "On the Design of Machines in Relation to the Operator," *Indus. Fat. Res. Bd.*, 1926, Rep. no. 36, 34.

[11] R. E. Hoke, *The Improvement of Speed and Accuracy in Typewriting*, p. 29 f.

ciently utilize the maximum number of strokes which alternate between the two hands.[12] The time interval between two strokes made by right and left hands is definitely shorter than between two strokes involving the same hand. By rearranging the keyboard of the typewriter, it could be made to be better suited to human abilities. Even right- and left-handed keyboards should be considered, so that handedness would not be a handicap to certain typists. All occupations should be subjected to a similar scientific analysis. Many machines are much more faulty than the typewriter. Some even require the operator to stand on one foot while operating a control pedal with the other.

Another factor in efficient motion design is the replacement of straight-line movements with circular ones. A circular movement of the hand between two points is made more easily than a back-and-forth movement between the points, particularly if this movement must be made at high speed. Suppose, for example, that three coins are flipped from the back of the hand and then caught one after the other by three successive downward sweeps of the same hand. The downward sweeps may be part of a spiral movement, or they may be three separate downward thrusts. The former pattern can be executed easily at high speed, since it has a continuous course and requires no sudden stops at the low and high points. Starting and stopping movements waste energy, as every automobile-driver knows.

Motion and time engineers frequently make use of a worker's feet to operate pedals and switches. The feet are made available for production as soon as seating is introduced. Since the legs are strong, they can be used for many heavy operations if the proper machinery is designed. A little thought will suggest many other duties which the feet may perform, and thereby save wear and tear on the arms. A pipe-organist's performance illustrates the important part the feet can play in skilled activities.

[12] J. M. Lahy, "French Psychologists Improve Typewriting," *Indus. Psychol.*, 1926, *1*, 333–337.

HABIT

If some patterns and sequences of movements are more efficient than others, then it becomes important to stabilize the combination by constant repetition. The actions thus become a habit which can be carried out accurately without thought. In this way the operation becomes mechanical. Since a specifically integrated combination of movements constitutes an act of skill, by its acquisition a high degree of proficiency is achieved. Almost anyone can drive a nail, so we may not consider such an accomplishment a very skilled performance. However, if we consider the activity from the point of view of the number of nails that can be driven per minute, then some individuals show a high degree of skill. Skill is not defined in terms of what is accomplished, but in terms of how it is accomplished. A skilled performer can duplicate a pattern of movements time after time, and his degree of skill is measured in terms of how much the pattern varies from trial to trial. For instance, the skilled tennis player can serve one ball after another in almost the same spot in his opponent's court. That he can do this means that a specific pattern of movements is completely under his control.

The ultimate achievement of motion and time studies is to transform an increasingly greater number of factory operations into effective acts of skill. Each job so modified becomes one in which a man can develop a high degree of perfection through training. Instead of a job's being one which anyone can perform with little or no training, it becomes one for a specialist. This elevates many factory jobs to a higher level, thus increasing men's pride in their positions. The worker's job is no longer one which almost anyone can do as well as he can.

Transforming jobs into acts of skill does not make it more difficult to find men to work on them. Men with adequate aptitudes ought to be selected, in any case. It does mean, however, that men should be given a period of supervised training. Since the final results of such a program lead to increased production, a con-

dition which increases the wealth of a nation, the full utilization of potential skills should not be overlooked. If contemporary industry must promote inefficiency in order to keep the supply down to the level of demand, there is a weakness in our economic structure. This weakness will eventually be ferreted out and our present industrial system replaced by one in which efficiency leads to a higher standard of living.

GENERAL EVALUATION

The preceding discussion serves to give a general idea of the nature of motion and time analysis. Those interested in the more detailed techniques of application may consult other sources.[13] Our treatment has been concerned with the presentation of a general setting of the problem, with emphasis on the psychological aspects rather than the mechanical.

The potential increase in the efficiency of production through these methods is apparent. With a large national debt, it is important that a high national income be maintained. This will be possible only if we make the efforts of labor productive. Modern industry has gone a long way in its technological improvements and, in a competitive world market, it must continue to make improvements. By no means have we reached perfection in methods; the alert engineer can find many more improvements.

Motion and time study also permits the standardization of work and pay rates. If all men are trained to do a job a certain way, then differences in productivity are not a matter of faulty methods. By standardizing different jobs, normal production in each can be equated. This leads to the reduction of unfairness in pay rates for different jobs and makes it possible for a superior inspector to produce relatively more than an inferior tool-maker.

In order to avoid some of the labor problems associated with motion and time study, a number of industries have found it

[13] R. M. Barnes, *Motion and Time Study*; also A H Mogensen, *Common Sense Applied to Motion and Time Study*

advisable to work with union representatives.[14] Thus, union time-study stewards, elected by union membership, may review standards set up and examine the records of the time-study department. Disputes may be settled by representatives of the company time-study department and the union time-study committee. In establishing standards, agreement between labor and management may be reached. It has been found agreeable to base the piece rate on the production of the average experienced worker. His production then is made the basis of standard or one hundred per cent performance. On the basis of such a standard, any improvement in standards must come as a result of the improved work methods, rather than as a result of increased demands on the worker's energy. Once a standard is set, it should not be changed without justification. Justifications for changes in standards which are acceptable to unions include: (1) change in methods of work, (2) change in equipment, (3) work added to or removed from the job, and (4) change in quality requirements. The success of plans of this sort clearly shows that labor does not oppose a sincere effort to utilize motion and time study.

As a matter of fact, the standardization of the job leads to greater fairness, in that work requirements on different jobs become equalized. The productivity of the average man, doing the work under prescribed conditions, becomes the measuring-stick; and superior performance, therefore, is recognized and can readily be translated into standard hours; that is, the number of hours it would take to produce the same amount at the average pace. The ratio between standard hours and actual hours would then be an employee's rating.

One of the by-products of job analysis (both in terms of motion and time analysis and in terms of ability and training requirements) is the equating of jobs. Jobs making similar demands on ability can have similar basic pay rates, thus eliminating some of

[14] *Labor and Management· Production Standards for Time Study Analysis*, Detroit: Local No. 2, U.A.W. — C.I.O. and The Murray Corporation of America, 1942.

the disparities created when rates depend purely on tradition or supply and demand. The establishment of pay rates acceptable to various groups of employees is one of the important problems facing society, as well as industry, today, and it is apparent that psychological analysis is contributing much to the solution of these problems. Since they are difficult problems, involving prejudices and greed, progress is made gradually through conferences and discussions, as well as by the objectification of standards.

11 THE ACQUISITION OF SKILL

INTRODUCTION

Industrial jobs are commonly divided into skilled and unskilled work. When used in this sense, the term *skilled* refers to jobs requiring trade knowledge; the term *unskilled,* to jobs requiring no special training. The trades require both the learning of certain manipulations and the acquisition of information or knowledge. Carpenters, masons, electricians, and tool-makers thus possess knowledge as well as the ability to perform certain activities. These two aspects of learning are quite independent of each other. A person could possess trade knowledge to such a degree that he was able to show other men all the steps in constructing a building, yet he might be unable to saw a board at right angles. Another person might be able to perform all of the necessary acts efficiently, but might not be able to construct the building. Knowing how a job should be done and being able to carry out the necessary operations are quite different processes. In the trades, these two aspects of work are possessed by the same individual, but, in a large number of factory operations, only the manipulative ability is required of the worker; hence he can be called an *unskilled laborer.*

To the psychologist, an act of skill is a learned pattern of movements. It refers to activity on the job and is quite independent of trade knowledge. A skillful worker, therefore, is not to be confused with one who knows a trade and belongs to a class known as

error learning in that its acquisition is largely dependent on the muscle sense, as well as other senses, whereas other forms of learning are relatively independent of the muscle sense. This means that the response is an end product for most forms of learning, but for acts of skill the muscular response serves also as a stimulus for further activity and so functions partly as a means to an end. When muscular activity serves as a guide to further behavior, the quantitative aspect of movement becomes highly important. In all learning, some kind of response is eventually made, but how it is accomplished is not always important. For instance, a string which opens a door may be pulled in a great variety of ways, and either the right or left hand may be used. This kind of response must be distinguished from one in which a specific pattern of muscular activity results in string-pulling.

Further, by trying out different streets, I may find the shortest route from my office to my home. From the differences in the appearance of the various corners, I can learn where to turn right, where left, and where to go straight ahead. Eventually, I learn the specific *way* home, but this learning will be in the form of knowledge rather than in the form of skilled movements. In order for such activity to be entirely one of skill, I should have to be able to go directly home when blindfolded, depending only on the feeling I get from my muscles. A certain amount of muscular exertion, rather than a visual pattern, would become the signal for the proper turns. If I had learned my way in terms of my muscle sense, I should not be able to get home directly by running, or by riding a bicycle, since these methods of traveling involve muscular activity which is different from that of walking. Obviously, the use of the muscle sense is not a good way to learn the route to my home, but, for many activities, its use is the best and smoothest method.

In serving a tennis ball, playing sequences of music on the piano from memory, laying bricks, or operating a lathe, the muscle sense becomes very important in controlling many of the movements.

In such cases the sensations of one movement become the cues for the next, which in turn initiate further movements. Even the gradual application of force to a lever is controlled by the "feel" of the preceding pressures exerted. The reliance on the muscle sense as a guide to movement becomes clear when a tennis-player is asked to demonstrate the last third of his serve. We find he is unable to do this without first going through the first two-thirds of the serve. The early phases of his movements are essential sources of stimulation for the later movements.

All of us have experienced the function of the muscle sense when running down a flight of stairs in the dark. Our reliance on the muscular sense becomes very apparent when an error in the pattern of movements is made. We have the "feeling" of having reached the floor and step forward. If the floor is a step farther down, the final movement is completely inadequate for the situation.

It is true that other senses may also be involved in skilled activity, but these other senses are primarily concerned with initiating the first parts of different sequences of movement patterns and act as a general source of guidance. The tennis-player, in serving, uses vision to orient his body. When serving in the opponent's court, he also may use the sight of the ball to initiate the armswing, but even the latter control becomes unnecessary after the player has learned to toss the ball at a constant height. In playing the ball from the opponent's serve, visual control constantly serves to orient the body and to call out and guide the proper stroke from the player's repertoire.

The facts that muscular sensations are essential to all acts of skill and that their acquisition is a problem of trial-and-error learning suggest a number of practical implications. Before presenting the applications to industrial training, it is necessary to analyze further the psychological processes involved. These applications will be treated in connection with the discussion of the specific aspects of the acquisition of skill.

THE FUNCTION OF THE MUSCLE SENSE IN SKILL

THE NATURE OF KINESTHESIS

The muscle or *kinesthetic* sense organs are located in the muscles and joints so that movements and different degrees of muscle tensions can be sensed through them. We are able to locate the position of our limbs by the "feel" they give us. Different kinds and different degrees of movement can therefore be distinguished from one another by the kinesthetic sense in the same way that visual shapes can be differentiated by the eyes. A baseball-player knows when he has hit the ball out of the park by the way it feels and does not have to see the results.

People differ from each other in muscular sensitivity, just as they differ in visual sensitivity, but they cannot get the equivalent of glasses to correct defects. Thus, if a man cannot distinguish between two degrees of movement, and if a job requires that such a distinction be made, he can never learn to do it with the required precision. To expect him to learn to do such a job is as unreasonable as to expect a person to learn to read when his eyes cannot accurately differentiate between the various letters of the alphabet. Skills which require fine differentiations in movement require an acute muscular sense. This sensitivity may vary for different groups of muscles, so that a given person's potential ability may be above average in kicking a football between the goal posts and below average in making a billiard shot.

Muscular sensitivity can be measured by placing different tensions on the muscles. A person may be asked to arrange a set of similar boxes according to their weights. By "hefting" and comparing them, he will recognize some as different and others as the same in weight. If he detects a difference when the weight differences exceed three per cent, and fails when the differences are less than that percentage, his acuity is set at three per cent. No amount of practice in a task of this sort will improve kinesthetic acuity.

For many industrial purposes, it is probable that practically all men have enough muscular sensitivity to learn the required operations. The kinesthetic sense is likely to be a limiting factor only in operations which require a high degree of co-ordination. The various sports offer the best illustrations of highly developed skills. Unfortunately, differences in muscular sensitivity have not been sufficiently investigated to permit a more precise statement. At present, we do not know to what extent motor-achievement test scores are related to kinesthetic sensitivity.

SOME IMPLICATIONS

If varying degrees of muscular tension produce different kinesthetic sensations, it follows that different rates of contraction will produce similar differences. This means that, after an act of skill has been learned at a certain speed, it cannot be as accurately performed at a different rate. Speed-up methods, as well as the slowing-down which may result from fatigue, therefore, are not conducive to the accurate performance of skilled acts. Under these conditions, accidents occur because of loss in skill. Training should include not only supervision over the pattern of movements, but over the pace at which the pattern is executed as well.

In order for an act of skill to be smooth and free, it is essential not only that certain muscles be used, but that others, particularly the opposing ones, be relaxed. Relaxation of certain muscles is as essential to the control of movement as is the contraction of others. Athletic coaches frequently stress relaxation in the training of their men. Unfortunately, many people cannot relax. For example, an adult who is learning to skate fears the pain and humiliation of falling, and so cannot relax properly. Such people must learn to relax by being taught to recognize the muscular sensations accompanying relaxation. The fact that children play with abandon and are relaxed in their activities probably explains why they acquire skill so readily.

Nervous people are characterized by their inability to relax.

Teaching such people how to recognize a relaxed state makes it possible for them to learn how to relax. Many have been cured of a variety of nervous disorders by this method of therapy.[1] Similar training should be an aid in the acquisition of highly complex skills. Since a nervous state is accompanied by muscular tension, it is apparent that working and learning environments which promote irritation and fear are not conducive to efficient motor learning and subsequent performance.

TRIAL-AND-ERROR LEARNING

All trial-and-error learning involves *selection*, as well as *association* formation. An act of skill requires that a certain pattern of movements be made in a situation, and that other movements not be made. If the pattern of movements represented by B K F is always made when a red light is flashed, and if such patterns as B L Z and B F K no longer are executed, it is apparent that the specific sequence B K F has been *selected* from all other possibilities. In addition to being selected, the elements of this sequence have to be tied together with the signal. This connecting of responses to signals is a matter of the *association* process. Since both *selection* and *association* are essential to learning acts of skill, it is important to know in what way a teacher can facilitate each of these processes.

ASSOCIATION FORMATION

The formation of associations takes place in all learning, be it trial-and-error or merely simple associative learning. It is through their formation that man's behavior is modified by experience. The essential condition for an association between two experiences is that the experiences occur simultaneously or in close succession. Seeing a man with a dog causes me to associate the two, so that on later occasions the dog reminds me of the man. Meat placed in a

[1] E Jacobson, *You Must Relax*. A more technical treatment by the same author is entitled, *Progressive Relaxation.*

dog's mouth causes him to salivate. This tie-up between the taste of meat and salivation *grew* in the dog and required no learning. However, if I ring a bell and then put meat in the dog's mouth, I build up an association in the dog between the bell and meat experiences. On later occasions the sound of the bell causes the dog to salivate because of the association which links the bell and meat. This change in the dog's behavior is acquired through experience and represents simple associative learning, in contrast to trial-and-error learning which always involves some selection in activity.[2]

Through a repetition of the same combination of experiences, the associations accumulate and become more stable and permanent. There is no way of eliminating the requirement for constant and frequent repetition. Although some individuals form associations more quickly than others, all continue to profit by further repetition. There is, therefore, no final or complete stage of learning. Even if performance is no longer improved by repetition, the benefits of practice show up in less rapid forgetting.

As the association is formed between the experiences of the individual who is being trained, one person cannot learn *for* another. Showing another person what I have learned does not help him, except in so far as he may thereby gain certain visual experiences himself. For example, if one person shows another how to wiggle his ears, the latter cannot imitate him.[3] He must first build up the associations in his own experience, and seeing another demonstrate an act does not give him these essential experiences. In other cases it is apparent that *imitation* does occur. If one person raises his arm, another can copy his action, but this is possible only because the one who imitates has previously learned how to perform this act. A demonstration, therefore, is effective only when another can already perform the required act. It does serve the useful purpose of communicating what is wanted, however.

[2] N. R. F. Maier, and T. C. Schneirla, "Mechanisms in Conditioning," *Psychol. Rev.*, 1942, *49*, 117–134.

[3] J. H. Bair, "Development of Voluntary Control," *Psychol. Rev.*, 1901, *8*, 474–510.

In some instances of learning, a demonstration may create certain useful experiences in the trainee. For example, I can show a man how to turn off a motor by pressing a button. Seeing me press the button and seeing the motor stop give him the experiences of "button-pressing" and "motor off," and, since these experiences occur together, they may be associated. Since the man can already press a button, he is not really learning to perform an act through imitation. Rather, the demonstration places two visual phenomena in close proximity and so relates or associates them in the observer's experience. When visual experiences are to be associated, there is some teaching value to the demonstration, but in such cases the learning is usually very simple. As a matter of fact, this same association could have been built up just as well or better by verbal instruction, which would require the learner to try the operation.

If one wished to teach an act of skill, a demonstration would be even less to the point. Showing a man how to juggle balls would not build up the necessary associations because, in this case, the association involves the feelings of the movements, feelings which can be obtained only by actually "doing." The foreman who teaches men by showing them how well he can perform skilled acts may be impressing the men by his skill, but he is not training them.

THE SELECTION PROCESS

In the selection aspect of learning, the coach or teacher may play an important rôle in reducing the time required for learning. Before showing how the learner may be aided, we must first describe how he learns by himself.

To return to the problem of learning to wiggle one's ears, it was found that this act can be learned after a period of trial and error. The learner goes through many facial manipulations, some of which include ear movement. Gradually, other muscular activities drop out and eventually only the muscle which moves the ear

is activated. This final stage of learning is achieved only after a high degree of selection.

Selection occurs through the action of reward and punishment. The "feels" of some actions are associated with failure, while the "feel" of a particular one is associated with success. As the learner distinguishes between the various muscular sensations, he can discover just what he did to produce the desired sensations. In this way, he acquires control over the movement. Since a person repeats the movements which are associated with the pleasant results and avoids those associated with the unpleasant ones, his activities become more and more limited and uniform. This limited pattern is then practiced and further integrated by the repetitions.

Some acts of skill are difficult to acquire either because the required pattern is very complex or because its elements have not previously been under control. Regardless of whether the task is easy or difficult, the nature of the process is basically the same.

In order to aid a person in the selection process, one must help him acquire the proper sensations. In the ear-wiggling experiment this was done by applying shock to the muscle which moved the ear. By having his ear activated in this way, the person learned how the ear movement felt. He was thus able to know when he moved the ear by his own efforts. The use of a mirror also served to make him aware of successful and unsuccessful attempts, but this method did not locate the "feel" of the ear movement as well.

Sometimes children are taught to write by having their hands guided. Pushing a child's hand through the motions does not cause him to use his own muscles, so he does not receive the necessary muscular sensations. In this case, the teacher gets the desired sensations, but these are of little help to the pupil. Such manual guidance, or the method of "being put through" the movements, has little value. Unless the guidance is so slight that the learner is induced to use his own muscles in the movements, it should not be used in training.

The most practical method of teaching is to let the learner initiate the movements, and have the teacher label them good, better, bad, and so on. These remarks serve as reward and punishment, thus aiding in the selection of the correct movements. By asking the person to stand closer, or farther, to take a shorter or longer hold, or to follow through, one can encourage actions of a certain type. The movement patterns will not be perfect at first, but when they are better than others, they should be encouraged. The selection should be progressively increased as proficiency is acquired.

It is clear that a teacher or coach who can evaluate a movement pattern in this way must recognize the "correct" method by the "looks" of it, rather than by the "feel" of it. For the learner, the reverse is true. When the coach demonstrates, he gets the "feel" and the learner gets the "looks." To prevent a coach from demonstrating and so reversing the essential sensations, it might be desirable to have teachers who cannot perform. The job of the teacher is to analyze the pupil's movements; he should not expect the pupil to be able to analyze his demonstration. The place for the swimming coach is out of the pool.

In order for teachers to learn how the best acts of skill "look," it is necessary for them to analyze the actions of others. Their own experiences of learning and doing have very limited value. In the first place, they cannot analyze their own skill in visual terms because they cannot see their own performances. In the second place, each teacher may assume that other people have the same difficulties that he himself had when learning, an assumption which is, of course, incorrect. In learning to play golf, for example, one person's greatest difficulty may be one of posture; another's may be that of not following through, still another's may be one of paying attention to the wrong part of the operation. Some golfers have to be told repeatedly to keep their eyes on the ball, while others have to be urged to change their grip on the club. A good teacher has to diagnose such difficulties, and he

learns his job from his study of the learning performances of others.

In factory operations, one must likewise correct postures and the way a tool is held, as well as indicate where the force of a stroke should be maximum to yield the best results. All of the incorrect movements must be recognized visually and they can all be corrected without a demonstration.

OTHER FACTORS WHICH INFLUENCE LEARNING

Since the training of industrial employees is gradually being recognized as an important problem, many firms have established training programs of one sort or another. In the majority of firms the foreman remains the teacher for most kinds of work. However, because the method employed in teaching is important, the training is gradually being taken out of the hands of the foreman and allocated to a special department. It is important that those assuming the responsibility for this training be qualified in analyzing the learning situation and in establishing effective teaching methods. There is no one method that should be universally used, since the method varies with the nature of the subject matter. Certain basic principles are applicable in all cases, however, and should be utilized.

THE PLACE OF THE DEMONSTRATION IN TEACHING

We have already pointed out the limitations of the demonstration method. This is a procedure which is used frequently, often under the most unfavorable conditions. For example, it is a common practice to have the trainee stand facing the demonstrator. In this position, the movements are seen by the trainee with all motions reversed. For many people, right and left are readily confused, even if backward-and-forward directions do not offer as great a difficulty. The reader need only attempt to draw a picture by looking into a mirror to discover how difficult it is to transpose all of one's actions.

The demonstration method has the virtue of giving the learner

an over-all picture of the end result. Thus, a music teacher may play over the assignment in order to give a pupil an idea of the unified result. Often, it is desirable to give an occasional demonstration, since the final effect exerts a control over selection, but in such cases the function of the demonstration is not one of teaching by imitation. A child learns to say certain words after hearing them. He attempts to match the sound he makes with the speech sound of the parent. The child is not imitating movements, since he does not watch the throat muscles, but rather is matching end products. By trial and error, he gets his end product to match that of the parent.

The industrial teacher may use the demonstration method in a similar way, but, when he does use it, he should realize that this is the only useful function of the demonstration. Since the performance can be adequately pictured by a very few demonstrations, these should be given sparingly. They should also be so spaced that they fall in progressive stages of learning; by this procedure the learner can make better and better matches with the demonstrated performance.

SUPERVISED TRAINING

In order for the trainer to aid the learner in the selection of movements, his help should be spread over a period of time, because trial-and-error learning progresses gradually. The more difficult the task, the more prolonged should be the period of supervision. Since, in a difficult task, a person cannot learn everything in one session, he is ready for different levels of selection at different stages in the learning process. The typist, for example, learns the position of the hands in relation to the letters, then learns to type single letters. Later, she learns to type syllables, then words, and, finally, groups of words. In each stage, different kinds of errors tend to occur and supervision must be adjusted to the level of the learning. The industrial worker can be helped only to a certain degree in his selective process; his own associations and

trial-and-error activity must do the rest. A supervisor, therefore, can handle a fairly large group of trainees by passing from person to person. He must not hesitate to leave each individual to his own devices until the latter is ready for help.

When the trainee reaches the stage where he needs help, this must be promptly available; otherwise, incorrect actions become incorporated, which are actually obstacles which must be overcome before correct habits can be formed. The importance of preventing the incorporation of "bad habits" has been demonstrated in a number of investigations. It is advisable, therefore, to begin training early. Early training is advantageous also because of the fact that there is a tendency for men with some experience to resent instruction, whereas beginners expect and welcome it.

Interfering habits may be established also when several men train the same workers. It is a mistake to think that a beginner should see how a number of experts do a job. In training streetcar motormen, it was found that learning progressed better when the apprentice was trained by one rather than by several motormen.[4] Each motorman has his own special "tricks." Thus, the use of a number of teachers leads to teaching the apprentice a number of interfering habits, rather than firmly establishing one procedure. If there are several ways to apply the brakes (long bites versus short bites of air), it would be well to determine which method is most effective from the point of view of learning as well as of effectiveness in stopping the car. When alternate procedures are equally effective, it makes no difference which is used, but only one should be taught to a given apprentice so that he may be spared confusion. If one procedure is superior to others, this one should be used by all and consistently taught to new men.

SPACED LEARNING

It is a well-established principle that a task is mastered more

[4] M. S. Viteles, *Industrial Psychology*, chapter 19.

readily if practice is distributed; that is, if the learning time is not condensed too much. Forty hours of practice spread over a period of two weeks, for instance, would result in better performance than the same amount of practice given in one week's time. Fatigue, lack of interest, and a reduction of effort tend to permit the appearance of incorrect habits, which are then practiced and learned. Long hours of practice not only may fail to produce proper returns for the time spent, but may actually be less effective than less practice.

In industry, it is frequently difficult to space the practice, since an employee is not willing to work part time while learning. It would be desirable, therefore, to find other duties that the trainee could perform satisfactorily and alternate this work with the learning of the more difficult operations. In such cases the trainee could spend an hour or two on the learning task in the first part of the morning and afternoon periods, alternating his duties with another who would learn in the second part of the morning and afternoon periods. This may appear impractical at first, but a little study would reveal that such arrangements can be made in many shops. Certainly, it is not efficient to pay an apprentice for eight hours of learning under conditions which are not conducive to rapid learning.

MOTIVATION

In order to keep up interest in learning a task, it is important that there be proper incentives for improvement. Telegraph operators, for example, tend to show increased skill when moved to more responsible positions.[5] The studies on the learning of the telegraphic language clearly show that "it is intense effort which educates." It is well known that motivation increases the effort, and so results in better work. The evidence from a number of

[5] W. L. Bryan, and N. Harter, "Studies in the Physiology and Psychology of the Telegraphic Language," *Psychol Rev.*, 1897, *4*, 27–53; "Studies on the Telegraphic Language," *ibid.*, 1899, *6*, 345–375.

investigations indicates that not only does motivation increase the *willingness* to do more, but also increases the *ability* to do more. It is probable that greater attention further improves the selection process and thereby increases the skill.

Motivation may be introduced by financial incentives, by competition, and by instilling co-operative attitudes. In the next chapter the subject of motivation will be discussed in detail. At the present time it is necessary only to point out that a teacher can increase the efficiency of men in mastering a given task by praising their work, showing them their record of progress (self-competition), and by putting persons of equal ability in competition with each other.

LEARNING PLATEAUS

In many instances of learning, a person reaches a stage in which there is no apparent progress. Periods of this sort are known as plateaus in learning. Sometimes such a plateau seems to be inherent in the nature of the task, sometimes the method of learning is a factor, and sometimes the plateau appears to be due to reduced application.[6] Whatever their cause, it is important that the trainee shall not become discouraged by his seeming lack of improvement. He can be told that the plateau is temporary, that with a little more application it will soon pass. The mere knowledge that the phenomenon is characteristic of learning and not a unique characteristic of his own is all that is necessary to prevent an attitude of "giving-up."

ATTENTION

After an act of skill is well learned, it is performed with little or no conscious attention to its various phases. During the early stages, however, there are so many things to watch that it is often confusing. The instructor can be of great aid in assisting the

[6] W. F. Book, *Learning to Typewrite*, chap. 15; also W. H. Batson, "Acquisition of Skill," *Psychol. Monog*, 1916, *21*, 92.

learner to put his efforts in the right place. Always the "correct" movements should be emphasized. To draw attention to "wrong" movements is harmful, in that it deprives the correct movements of necessary attention. In the study of the acquisition of the control of ear movement, it was found that, when a person tries not to move the eyebrow while moving the ear, he is more likely to move the eyebrow in connection with the ear than when he attends only to the ear movement. It is a generally recognized principle at the present time that using "don't" in giving instruction is poor pedagogy.

When movements have to be made in rapid succession, attention should be placed on the rhythm. In typing the letters t-h-e, the pattern rather than the elements is stressed. To promote the experience of the pattern, the same combination is repeated many times in succession. A closely knit muscular pattern of movement cannot be achieved by adding together many separate acts. Attention cannot shift from one segment to another quickly enough to mold the skill into a unified whole. A smooth act of skill is no more a mere aggregation of muscular movements than is a triangle a cluster of points.

Attention on the end result of the action pattern also tends to guide the execution of a pattern. We throw a baseball or drive a tennis ball where we look. When we make vocal sounds, we attend to the result they produce. When driving a golf ball, we attend to the follow-through or the end of the swing. Always, the attention must be well ahead of the movements; otherwise each separate unit becomes connected with the attention rather than with the preceding movement. In order to gain rapid and smooth performance, the pattern cannot be split into separate parts without necessitating separate acts of attention.

It follows that a unit of skill cannot be divided into parts which can be learned separately. This breaking-up of a task into parts is feasible only when the parts are actually separate units of performance. Thus, posture in golf can be separated from the drive,

whereas juggling a ball with one hand cannot be separated out of a pattern which utilizes both hands. In dividing jobs for production purposes, it is important that effective movement units be retained. Ordinarily, one thinks of a manufacturer's product in terms of the number of physical parts from which it is assembled. From the point of view of skill, one should think of the product as the assembly of units or patterns of skill.

The distribution of work in the production line would benefit by an analysis of the finished product in terms of unified acts of skill. One man could do part of the work on three or four different physical parts and another could complete the work on some or all of the same parts. Although this sort of approach is actually practiced in many cases, it is clear that the dominating unit still is the physical rather than the psychological unit.

The same principles should be considered in the design of machinery and instrument panels. If control mechanisms and dials are arranged to simplify the attention as well as the movement requirements, the learning time and operational efficiency can be definitely improved. When attention on widely separated parts is continuously required, the opportunities for confusion and lapses in attention are greatly increased. Pairing of related operations, giving the important manipulations central positions, and having the controls arranged in the order in which they must be used are types of improvement which can frequently be made.

THE TRAINING OF TRAINERS

The potential benefits inherent in proper teaching are demonstrated by an experiment conducted under actual factory conditions.[7] Approximately eight hours of special training were given to the men who taught the operation of a stitching machine. The training emphasized: (1) techniques of establishing favorable so-

[7] This experiment is being conducted by Mr. Alex Bavelas, of the University of Iowa. The experiment is still in progress, but Mr. Bavelas has kindly permitted the author of this book to incorporate the results obtained up to the present time.

cial interrelations; (2) methods for increasing motivation; and (3) procedures by which the trainer could guide and lead rather than push the workers. The training did not attempt to modify the former method of teaching the technical aspects of the work. The basis of the instruction, therefore, may be regarded as one which influences the work environment by changing the attitudes of the trainer toward his job of teaching and toward his trainees. The discussion method was used entirely for training the trainers.

The effects of the brief training are shown graphically in Figure 15. The trainees' rate of learning a stitching operation is distinctly more rapid after their trainers had received the special instruction than it was before the special teaching methods had been introduced. Similar results are presented in a different way in Figure 16. The solid lines show the progress of two workers who received their training before the trainer received the special instruction. After the trainer received four hours of instruction, he taught the operation to two other workers. The progress of these two workers is shown by the broken lines. When the trainer had received his full eight hours of instruction, he taught two more workers to do the stitching operation. Their learning records are shown by the dotted lines. It is clear from these curves that the rate of improvement of workers is directly related to the amount of instruction that their trainer has received. Despite the fact that individual differences in learning are very marked, the benefits of the special training are so great that they predominate over the natural variations in aptitude.

In this experiment, the training of trainers was confined to certain aspects of the teaching of workers. If striking improvements can be shown by this limited instruction, it is apparent that much more can be gained by a larger program of teacher training. It seems safe to conclude that the use of psychology in the teaching of workers is still in its infancy and that a factory training program is a sound and fruitful direction in which the personnel departments in industry may be extended. Not every training program

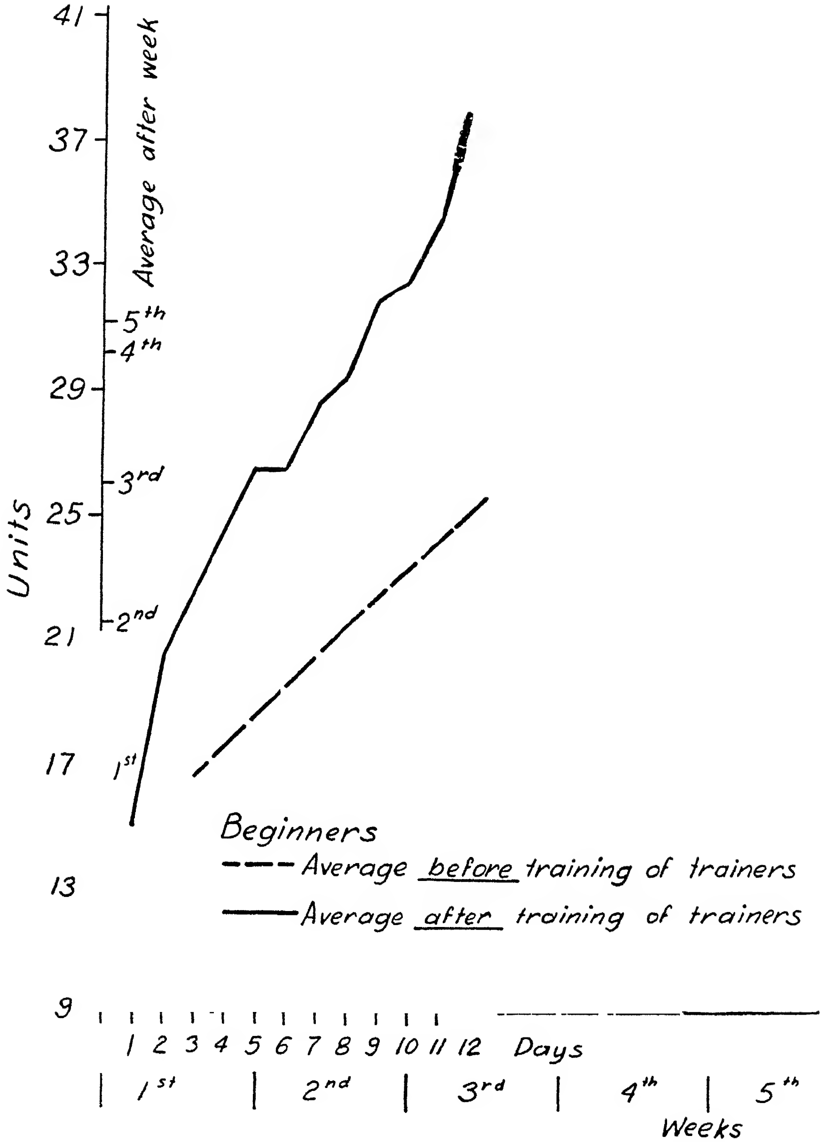

Figure 15. Learning Curves of Employees

These two groups of employees were trained before and after instructor-training was introduced. Workers who learned stitching operations after the instructors were trained, learned more rapidly and achieved much higher proficiency than workers who learned before the training methods were adopted. (Courtesy of A. Bavelas.)

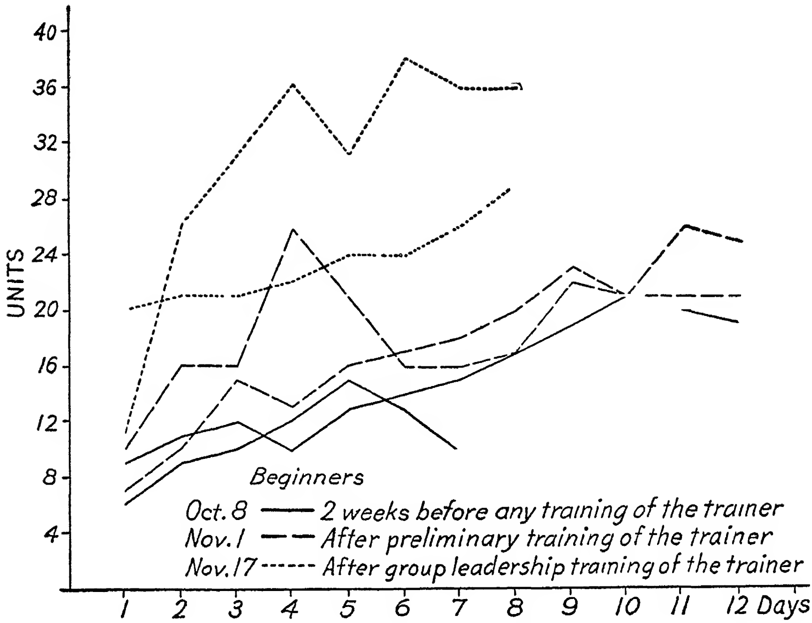

Figure 16. Learning Curves of Six Beginners

These employees were trained by the same instructor as he received special training in the handling of employees. The curves show that the rate of learning increases as the instructor receives more special training. (Courtesy of A. Bavelas.)

will justify itself, however, for such a program, if it is to be successful, must be carefully planned and executed in the light of modern developments in psychology.

EMPLOYEE TRAINING IN GENERAL

The preceding treatment of learning has been confined largely to the psychological aspects of the acquisition of skill and the relation between skill and motion study. The discussion of leadership training for foremen in Chapter 5 and the discussions of motivation in Chapters 12 and 13 also should be considered in this connection. In addition to these topics, a complete training program must take into account the teaching of trade knowledge and the informing of workers on company policy. These are important

phases of a well-rounded teaching and training program. Many companies have established programs designed to meet their own particular needs. It should be noted that motion pictures and other visual and auditory aids, as well as demonstration and discussion techniques, may be very effective in teaching subject matter which is in the form of knowledge.

The direction of a general company training program should be in the hands of specially trained individuals. Readers interested in gaining a knowledge of some of the present practices may consult other sources.[8] Since the type of training will vary with the nature of the industry, it is difficult to draw simple conclusions for the general reader. The subject matter already discussed, however, includes the psychological background for an understanding of methods in general practice, and it is hoped that it will furnish a basis for the evaluation of such aspects of training as may fall within the engineer's and supervisor's areas of activity.

[8] W. D. Scott, R C Clothier, S B Mathewson, and W. R Spriegel, *Personnel Management*, Part III; also H. Moore, *Psychology for Business and Industry*, chap. IX.

12 BASIC PRINCIPLES IN MOTIVATION

INTRODUCTION

We may think of man as having a complex repertoire of behavior any part of which conceivably he may display on a given occasion. Whether he developed the various possibilities for behavior by learning or through heredity and growth is beside the point for our present purposes. The fact remains that man has many potential abilities, but only some of these come to expression on any given occasion. The behavior which comes to expression represents a man's performance, whereas his potentialities for behaving represent his abilities.

The problem of bringing ability to expression is one of motivation. We understand the *why* of a man's actions when we know his motive. When the detective is seeking the motive for crime, he is attempting to discover the *why*. For example, practically every man has the ability to fire a gun and kill a particular woman in the community, but very few people will do it. If a body is found in an abandoned shack, the detective seeks to find a motive for the killing. Suppose he finds that the victim's son-in-law has insured her for ten thousand dollars, naming himself the beneficiary. Immediately, the son-in-law is under suspicion. A motive for the crime has been uncovered, and the motive supplies an explanation of the murder.

The motive, then, is a reason for the expression of a particular ability. If we can control the motives of men, we can control the

behavior which they will express. A man can get others to work for him by offering money for work. A man will do as another wishes, provided the latter can properly manipulate the motivating conditions. With the proper control of these conditions, a few individuals can exert a great influence on the behavior of others. The only limitation on the extent of this control is that no individual can be motivated to do that which he is unable to do. Motivation, then, is a way of bringing to expression an ability which a person already possesses.

The layman speaks of a man's *will* to do something, and he distinguishes between the will to do and the *ability* to do. The word *will* implies that there exists a power within the individual which determines the expression of behavior. Since psychological investigations have not supported the existence of such powers, the student of psychology finds that the concepts associated with the term *motivation* are much more satisfactory. Our treatment of the behavior of man, therefore, will be in terms of motivation, and it should be understood that *will* and *willpower* are obsolete explanations which cloud rather than clarify the understanding of man's behavior.

THE NATURE OF A MOTIVATING SITUATION

THE RELATION BETWEEN NEEDS AND INCENTIVES

A motivating situation has both a subjective and an objective aspect. The subjective side is a condition in the individual which is called a *need*, a *drive*, or a *desire*. The objective side is an object outside the individual which may be called the *incentive* or *goal*.

When the natures of the need and of the incentive are such that the obtaining of the incentive satisfies (that is, removes) the need, we speak of the situation as *motivating*. For example, hunger is a need and food is an incentive. The food is of such character that, when it is obtained, it satisfies (that is, removes) the hunger need. If both food and hunger are present in an animal's experience, the animal will carry out activity which brings the two together, pro-

vided the activity is in his repertoire. If we place food at the end of a pathway, a hungry rat will work for the food if it has previously learned the relationship between food and pathway. Similarly, human beings will work if they have learned that such activities obtain incentives which satisfy their needs.

The strengths of both needs and incentives vary from time to time and from individual to individual. Hunger, for example, can be increased by lengthening the period of food deprivation. The presentation of the same incentive, therefore, will produce a stronger motivating situation in individuals in which the need is intense than in individuals in which the need is slight. Hungry animals will take more punishment in obtaining food than will partly satisfied animals; likewise, hungry men will take greater risks in obtaining food than will men who are well fed. Similarly, the same degree of hunger will be associated with different degrees of motivation when various food incentives are used. A child will do more for a piece of candy than it will for a glass of milk. It is clear, therefore, that the intensity of motivation can be altered either by changes in the need or by changes in the incentive.

INNATE NEEDS

Some needs are inherent in the nature of the organism and occur in all animals. These needs may be called *natural* or *innate*, since their appearance is quite independent of past experience. Hunger, thirst, maternal drives, sex urges, and perhaps curiosity are generally regarded as constituting the basic innate needs. Except for curiosity, each of these needs can be shown to be associated with a form of internal stimulation.

In the case of hunger, stomach contractions offer the main source of stimulation. A dog which has been deprived of food for a day will show the eating pattern of behavior when confronted with a pan of food. If he has been induced to swallow a rubber balloon, which can be inflated by an attached hose, his stomach can be filled with air and the stomach contractions quieted. With

the removal of this source of stimulation, the dog is no longer motivated and the eating behavior does not come to expression. On the other hand, a dog will eat an indefinite amount of food if the food which he eats is periodically removed from his stomach.

Similarly, thirst is found to be dependent upon sensations produced by dry membranes in the throat. The maternal need, which causes the female animal to care for its litter, is associated with tensions in the milk glands. Sex urges are stimulated by the physiological conditions of the gonads. Curiosity, if localized, seems to be associated with the brain and is more pronounced in animals having greater brain development than in animals with primitive brains. Curiosity is satisfied by the exploration of strange objects; it is perhaps the basic urge which drives men to make scientific investigations.

ACQUIRED NEEDS

The *acquired* needs are dependent upon experience. If other boys in the neighborhood have bicycles, our son acquires a need for one and he will work hard to satisfy this need. Women acquire needs for lipstick and permanent waves in a similar manner. Needs for such incentives as indoor plumbing, a certain standard of living, and pleasant working conditions are acquired by the experiences which the environment offers. The acquired needs are just as réal and intense as the natural needs; they differ only in the way in which they were obtained.

The acquired needs cannot be localized in specific parts of the body. This is not surprising, because they are acquired through experience and probably are attributable to changes in the nervous system. Such changes are primarily caused by modifications of the function of the brain. It is significant that animals with the most highly developed brains show the greatest number of acquired needs.

From the very nature of the acquired needs, it follows that people cannot revert to methods of living which are more primi-

tive than the ones to which they are accustomed without experiencing deprivation. To argue that workers are better off today than were their predecessors a century ago and therefore should be more satisfied is quite beside the point. Since men had fewer acquired needs a hundred years ago, the same conditions which now represent deprivation did not do so then. The removal of indoor plumbing would now cause great deprivation, although there was a time when no one had it. To speak of modern advantages as luxuries, and hence unessential, is to deny the reality of acquired needs.

Civilization must move forward and never backward by the very nature of man's strivings for satisfactions. Too much deprivation produces frustration and releases the undesirable forms of behavior discussed in Chapter 4. As more and more people acquire need-satisfactions, a greater number experience these possibilities and so acquire the needs in turn. The accumulation of needs in man serves to drive the standard of living upward.

SELF-RESPECT AS A NEED

In man, we find a highly developed ego. Whether its origin is in the basic tendency to survive or whether it is acquired through social experience may be a debatable question. The fact remains that man has a need for respect from others. He demands certain freedoms and certain considerations in order to satisfy his pride. He will work to gain the respect and admiration of others and is frustrated if he is blamed and criticized. It is the ego need which makes man competitive and makes him strive for social status and power.

In most of us, this need does not become clearly conscious. When not directly engaged in the war effort, men feel left out of things, but do not quite know why they are dissatisfied. When a child is with his gang, he is more likely to be rude to an adult who interferes with his activity than when he is by himself. If we are puzzled at his behavior, it is because we forget that he is forced to

maintain his status within his own group. Later, he is sorry and does not know why he was so ill-mannered.

In telling of his "run-in" with the boss, the workman will exaggerate the situation and describe how he told the boss "where to get off at." This apparent "bragging" is only natural in such a situation, since it is the individual's way of protecting the ego.

The fact that this need is vague and largely unconscious makes it difficult to recognize. Many people who have trouble in getting along with others overlook the fact that men strive to retain their self-respect. A student of behavior must recognize the fact that, when man is in his own social group, he must maintain his social standing, and that to interfere with this tendency is to frustrate a strong need. Anyone who degrades another in front of other people may expect to elicit violent resentment.

THE NATURE OF SUBSTITUTE INCENTIVES

As already pointed out, the incentives, when obtained, tend to satisfy the needs. Eating food removes stomach contractions; drinking water removes dryness of the throat; nursing the litter relieves the tensions produced by glands distended with milk; sexual behavior alters the physiology of the glands; and the exploration of a new area removes curiosity. The acquired needs, likewise, are satisfied by the attainment of specific objects.

Often incentives are not available for the satisfaction of needs. This does not necessarily result in deprivation, since substitute incentives give satisfaction in varying degrees and prevent frustration.[1]

The childless woman may shower her love on a dog; the small boy may accept a cooky in place of candy; and the workman may accept a raise in pay rather than a promotion to foremanship. In each case the substitute must have some relation to the real incentive. A compromise arrangement usually is a good substitute

[1] M. Henle, "An Experimental Investigation of Dynamic and Structural Determinants of Substitution," *Contrib. to Psychol. Theory*, 1942, *2*, no. 3, p. 113.

incentive because it contains some of the elements of the demands of both sides of a dispute. For this reason, management-labor disputes can lead to conciliation if the mediation board can work out a compromise which contains some of the real demands of each of the disputing parties.

POSITIVE AND NEGATIVE INCENTIVES

In the sense that incentives satisfy needs, they have a *positive* or attracting influence and lead to pleasure. Unpleasant objects have an opposite effect, so we tend to move away from them. Such objects may be called *negative* incentives. These do not satisfy needs, unless one wishes to say that the body has a need to escape from pain. Because people tend to move toward positive incentives and away from negative incentives, we may think of them as being pulled toward certain activities and pushed away from others. There are, therefore, two ways of influencing behavior; one associated with reward, and the other with punishment.

For example, I may induce my son to mow the lawn either by offering him pay or by whipping him for not doing it. In the latter case he avoids the whipping and is pushed into the work. It must be recognized, however, that mowing the lawn is not his only way to avoid punishment. He might get his mother to interfere, he might test my strength if he has reached a certain age, or he might run away from home. The pushing method controls the behavior in so far as something is avoided, but it does not exert clear control over the direction in which we wish to push the behavior. To obtain complete control, it is necessary that alternative actions also will be avoided. I must figuratively fence in the boy so that he cannot escape the unpleasant task. It is like trying to control the course of a toy automobile by pushing it away from all points except one. Even with this precaution, I still have to reckon with resentment and future misdemeanor when I am dealing with living things.

The reward method avoids these difficulties, since it guides in terms of the end desired and results in satisfactions rather than resentment. Like the toy car, the boy may be pulled toward the objective and so be under constant control.

Too much of the control of men in industry has been of the push variety. Foremen punish with abusive language and threaten discharge. The men may thereby be induced to avoid loafing, but, instead of loafing, they may busy themselves by walking off with supplies, damaging equipment, or merely looking busy. In the next chapter we shall present experimental data which clearly show the superiority of praise over reprimand in influencing work.

The only effective place for punishment in the control of behavior seems to be in situations in which some form of behavior is to be avoided. If, in a given situation, there are a dozen actions that are acceptable and only a few that are undesirable, it may be more effective to punish in connection with the few rather than to reward in connection with the many. Here, the value of punishment lies in the fact that the situation contains more favorable than unfavorable possibilities, not in the fact that punishment exerts superior influence. For example, we may wish a child to avoid a lamp and permit him to play with anything else he desires; or we may wish a workman to keep away from a control box, but do not care how he does it. In such cases punishment in connection with the undesired act may serve its purpose, but even then there are some undesirable possibilities. The child and the workman may associate the punishment with the person who administers it, rather than with their own actions. They then avoid the one who punished them. Thus, the spanked child may fear the parent and avoid playing with the lamp only in the parent's presence.

DISCIPLINE

From the foregoing discussion, it can be seen that punishment,

as a method of controlling behavior and maintaining discipline, has definite limitations. Punishment can be used to prevent or inhibit undesirable behavior, but in such cases it should be administered so as "to let the punishment fit the crime." Antisocial behavior in the child can be inhibited more effectively by sending him to his room than by corporal punishment. Removal from the group is clearly related to the child's refusal to play co-operatively. For the same reason, it is better to remove a careless worker from his special job than to subject him to the foreman's wrath. Any punishment that degrades or injures the ego is as likely to create resentment as it is to inhibit the undesirable act. There is no such thing as teaching men to have discipline for its own sake. It is always related to the situation, and each situation must develop its own controls. We have seen also that intense and prolonged punishment produces frustration (see page 65 f.), thus making the person unresponsive to goal-behavior. These and other dangers are inherent in disciplinary action involving the fear of punishment.

The futility of controlling behavior by fear is clearly illustrated in data found in a captured Gestapo record, "Die Lage," dated August 23, 1944. This publication reveals that death sentences in Germany for the five-year period 1939–1943 increased as follows: 99, 926, 1391, 2660, and 5336. Political crimes were the primary reasons for these death sentences. Thus punishment for opposition to Nazi rule increased, rather than decreased, opposition. It is quite characteristic that once punishment and restriction of freedom are begun, the need for extending them increases and the situation gets worse rather than better.

Discipline is more effective when men positively desire to co-operate than when they fear not to do so. The desire to co-operate can be built up by associating certain kinds of behavior with reward and by denying these satisfactions when the desired behavior is not forthcoming. Most situations can be arranged so that people find that it is more desirable to co-operate than to

become disciplinary problems. A few maladjusted individuals may not respond to such situations, but, even in these cases, the cause is likely to lie in past abuse. Withholding rewards, of which social approval is one of the most important, is a form of punishment only in that this result is less desirable than obtaining a reward, but it is not a form of active punishment. The method of withholding reward or approval permits a free choice between alternatives, thus it is not likely to create resentment.

CHOICE-BEHAVIOR

Choice-behavior occurs when there is a conflict between two conditions of motivation. If a person is motivated in one way only, there is no doubt about what he will do. When two motives are present at the same time, however, two forms of actions tend to be brought to expression. In the end, one wins out, but in the meantime the person has the experience of making a decision.

THREE TYPES OF CONFLICT IN MOTIVATION

There are three types of conflicts between motives.[2] The *first type* is a conflict between two positive attractions. If the employees of a factory are offered a choice between a certain increase in the rate of pay or hospital, sickness, and old-age benefits, they will have to choose between two attractive goals. Eventually, the alternative that seems to offer the greater total need-satisfaction will be chosen. It must be recognized, however, that needs are an individual matter and that all men would not necessarily make the same choice.

The more evenly balanced the attracting forces are, the more difficult it will be for one of the forces to win out to produce a decision, and the less difference it makes which alternative is chosen. A little analysis of the situation frequently reveals that one goal is more attractive than the other. If this analysis does not produce a choice, then it is futile to continue the state of in-

[2] K. Lewin, *Dynamic Theory of Personality*, p. 123.

decision. Flipping a coin would be an aid to many who have difficulty in choosing in such cases.

That difficult choice-situations of this type are attributable to evenly balanced motives becomes clear when one of the alternatives is changed. If the employer raises the proposed rate of pay, the men are immediately able to resolve the conflict.

The *second type* of conflict in motives arises when positive and negative incentives are associated with the same action. People avoid a course of action which is associated with a negative incentive, but, if a positive incentive is introduced, they will be impelled toward and away from it at the same time. If these opposing forces are approximately equal, a conflict in motives occurs. For example, because work on the night shift conflicts with the normal mode of living, men do not choose it. Rather than force the choice in order to staff this shift, one could increase the pay rate. With a certain difference in the rate of pay, some individuals would have difficulty in making a choice, but the conflict could be resolved by further increasing the difference in pay. At a certain differential pay rate, the proper proportion of men could be induced to choose the night shift.

All people can be caused to choose unpleasant incentives if thereby they attain more pleasant ones. This procedure does not utilize force, but allows choice, and the action is determined by the positive goal.

The reverse of the above situation may also occur. Robbing a bank offers attractions in the way of finances, but, connected with this behavior, is the possibility of an unpleasant prison term. Even if the thief is not caught in the act, the persistent fear of detection remains unpleasant. Thus, negative incentives attached to positive ones reduce the attractiveness of the latter. In all cases the conflict is resolved in terms of the relative intensities of the many repelling and attracting forces.

The *third type* of conflict involves two negative incentives acting from opposite directions. The individual in this case

must choose between the lesser of two evils. Examples of this type of conflict are the cases of the boy who must choose between the unpleasantness of mowing the lawn and punishment, and of the workman who must choose between the unpleasantness of being changed from one job to another and losing his job. This type of choice-situation has no positive aspect and is actively unpleasant. The disadvantages inherent in the use of punishment to force action associated with negative incentives has already been discussed in the earlier part of this chapter.

THE IMPORTANCE OF ANALYZING THE CHOICE-SITUATION

When men go out on strike, a majority have made a choice. This choice may have been made in either of the second or third types of conflict. In both cases one may assume that going on strike is a negative condition. Men do not strike because this action is pleasant. If connected with the strike there is the attraction of better pay, shorter hours, or some other positive goal, then the strike action may be chosen because it must be passed through in order to reach the goal. In this case the situation becomes a case of the second type of conflict. The more attractive the goal (which depends on needs), the more readily the strike action tends to be taken. The more unattractive the strike experience, the more hesitation will be displayed. This latter point may suggest that the problem may be solved by making strikes highly unpleasant. Before accepting this remedy, let us examine the conditions which accompany the third type of conflict.

Suppose the choice situation is one in which working under existing conditions is a repelling experience. If striking is accepted by the workers as an alternative, then each person is confronted with two negatives. In such cases, since the person is trapped by negative forces, a frustrating situation is gradually built up. As striking is made more and more difficult, other alternatives, such as attempts to escape, arise. Leaving the job

and going on relief, if no other jobs are available, is an escape. Modified methods of striking, such as the slow-down in production and the "sit-down" strike, are other forms of escape. The continuation of this situation eventually leads to mass frustration and the formation of frustration-instigated movements in which attacks on the barriers dominate and goals cease to appease (see Chapter 4).

Let us now return to the method of increasing the negative value of the strike as a means of influencing choice-behavior in cases in which the second type of conflict in motives exists. If striking is made a highly unpleasant alternative to continued work, choice-behavior is actually prevented. This denial of a choice introduces an element of frustration, which in turn leads to the experience of unpleasantness in the working situation. As a consequence, the former reaction to the attractiveness of better working conditions gradually becomes replaced by a reaction to the unpleasantness of the present conditions. When this occurs, the situation changes from one involving the second type of conflict in motives to one involving the third type. Both work and strike are unpleasant and exert opposite and negative forces. Thus, the technique of increasing the negative force in a situation which has both positive and negative values may fail to solve the problem satisfactorily because it alters the situation rather than modifies the balance between the positive and negative forces. The remedies in labor disputes, therefore, must neither deny choices nor exclude positive attractions. In order to maintain positive values in working conditions, these conditions must be sufficiently satisfactory to make them relatively attractive.

All attempts to influence the decisions of people should take into account the nature of the choice-situations with which they are confronted. We cannot say that increased pay will achieve certain results unless we analyze the actual choice-conditions. If high pay does not motivate workers, then it merely means that the proper incentives have not been used. During the war, high

pay failed to guarantee security, improve housing, increase the available food, or make clothes a form of ego satisfaction. Yet many employers wondered why people quit good-paying jobs.

A CHOICE ALWAYS INVOLVES THE SELF

The need which is present in every motivating situation is located in the individual who is behaving. It follows, therefore, that behavior is oriented with reference to the self. Ordinarily, one speaks of self-oriented behavior as selfish. It would be more apt to distinguish between social and anti-social behavior. It is selfish to behave in such a way as to win the approval of others, but such behavior is not frowned upon.

If I choose activities which raise the standard of living for everyone, I am called a benefactor, yet I have satisfied my own needs. It is only when I satisfy my needs by depriving others of the satisfaction of their needs that I receive social disapproval. It is such behavior that society calls selfish. Men need social approval to satisfy their needs and many spend large amounts of money to buy it back when it is lost. It is apparent that anti-social behavior is really near-sighted self-interest and that people who engage in such behavior neglect to consider the negative incentive of social disapproval.

Because choice-behavior depends upon a person's needs, it is not surprising that a great many people look out for their own personal interests. To expect labor to struggle for the interests of the farmer, industry to recognize unions, and Americans to be patriotic and loyal to their country is to expect a good deal. Such behavior occurs only when it has become a habit and when it is apparent to the individual that a gain for the farmer helps labor, that union recognition solves labor problems, and that patriotism increases a citizen's security and welfare. When the enemy is at our border, almost anyone can give up his interest in profit and become a patriot. Similarly, a man will do a good day's work when he sees it is to his interest to do it, and an employer will

institute reforms when such action has an obvious attraction to him.

Social evils, such as rackets and "black" markets, prosper because people patronize them to satisfy an immediate need. Each individual reacts to the needs as he experiences them. The illegal operator conquers by the technique of dividing society into isolated individuals who react to an immediately satisfying incentive which the operator can supply. Some of these individuals are so naïve with respect to social disapproval that they openly boast about the patronage they give to anti-social organizations.

THE LEVEL OF ASPIRATION

SUCCESS AND FAILURE AS REGULATORS

Success and failure are forms of reward and punishment in that they satisfy or deny the ego's needs. What constitutes success and failure is a relative matter, and the psychological process that determines whether a particular action gives the satisfaction of success or the frustration of failure is one's *level of aspiration*.[3]

Suppose a person is asked to roll marbles into a hole from a distance of twenty feet and to continue practice until he can make a score of nine successes in ten trials. In terms of actual achievement, the person would suffer continual failure and soon give up. However, this is not the way the person operates. Regardless of the instructions given, the person sets up his own criterion in terms of his ability to achieve success. He may set his aspiration at getting one marble out of ten in the hole. If this leads to persistent failure, the level of aspiration may be lowered to one out of twenty marbles. As the performance results in considerable success, the level of aspiration is raised so that some failures are introduced. The difficulty of the situation and the ability of the individual largely regulate the level which a person's aspiration

[3] F. Hoppe, "Erfolg und Misserfolg," *Psychol. Forsch.*, 1930, *14*, 1–62; also Lewin, *op. cit.*, pp. 250–254.

will reach. Success tends to raise the level and failure to lower it.

In looking over the fighting record of Joe Louis, we might suppose that he always experiences success. This view neglects to take into consideration his level of aspiration. In a particular fight, his aspiration may be to win in the third round. If he wins in the eighth round, this performance becomes an instance of failure. He then trains harder so that he can achieve his own goal on the next test of skill. For a superior performer in any sport to defeat an inferior opponent does not give the one the satisfaction of success and the other the experience of failure. If it is agreed, however, that the superior player should "spot" the inferior player a certain number of points, then success and failure become real experiences.

The level of aspiration functions as a regulator of success and failure and serves to protect the ego from frustration, while, at the same time, it keeps the goal ahead of actual achievement. Under conditions of normal and healthy functioning, a person never achieves his goal because the aspired goal moves ahead as it is approached. This permits the person to continue to exert effort.

THE INFLUENCE OF SOCIAL PRESSURE ON LEVEL OF ASPIRATION

When a person is a member of a group, his level of aspiration is influenced by the performance of the group. If he is below average in performance, his level of aspiration is too high for his ability; if he is above average, his level tends to be too low. In order to keep the level of aspiration of each individual commensurate with his ability, it is desirable that only individuals of similar ability compete with each other.

In the industrial situation, the demands for production are usually calculated in terms of average performance. Inferior producers, therefore, are under pressure, since their level of aspiration tends to be raised by the superior work of the others. They become dissatisfied with their jobs and may quit, or they may

rationalize their poor performance by blaming conditions outside themselves. They find fault with their tools, their associates, or their foreman. People with inferiority complexes are likely to have levels of aspiration which are too high.

In contrast, because men with superior abilities acquire levels of aspiration which are too low for their abilities, they experience success without exerting themselves in any large degree. They tend to be self-satisfied and overbearing. Industry suffers a great waste in potential production because it does not adequately utilize the abilities of superior workers. It is true that such individuals do highly satisfactory work, but, in terms of potential ability, their achievement is low. Thus, industry tends to motivate inferior individuals while neglecting to tap the latent talent of the superior ones.

A person who is well adjusted to his work has the proper balance between ability and level of aspiration. It is important that production supervisors and men assigned to industrial training aid their trainees in finding their proper levels of aspiration. Men should not expect too much improvement in themselves, but they should always expect some. In all acquisition of skill, effort tends to fall off when the aspiration level is not advanced. Superior individuals are the most likely to be lax in this respect because of the external influence which arises as a result of comparison with others. Always, the expectation should be in terms of one's own performance level. For this reason, competition between equals always produces the best possible performance.

In situations in which it is claimed that strict discipline is necessary, one usually finds that the basic trouble is one of low aspiration levels. The problem boy does not want to improve and gain social or teacher approval. Men with poor morale do not want to do better work, so management feels that it must put on the pressure by using penalties. Under the proper management, it is unnecessary that low levels of aspiration should exist in a large proportion of individuals. The method of dealing with such a

condition when it does exist is to raise aspiration levels; this requires the improvement of morale (see Chapter 5).

Isolated cases of problem employees always arise. Selection methods may prevent their employment. If they are employed, they may be discharged without opposition from the union. Discharge becomes anti-social and irresponsible only when it occurs for reasons other than complete inability to function on a job. Discharge, used as a threat (punishment) or to disrupt employee organizations, is obviously a sign of mismanagement.

13 MOTIVATION AND WORK

THE NEEDS WHICH MONEY SATISFIES

MONEY, in itself, has no incentive value. Since our economic structure has made it a medium of exchange, however, it can be used to obtain the real incentives. Money is thus sought after in our society because of what it represents. Chimpanzees have been trained to work for poker chips which they found they could exchange for food. The poker chips thus became sought after and saved. The chimpanzees even begged from one another to obtain them, and they learned the difference between the high- and low-value chips.[1] In man, the exchange value of money has become so ingrained that he sometimes appears to be seeking money for its own sake rather than for what it represents.

Before we can understand man's interest in money, it is necessary to appreciate the fact that men in different income brackets are not working for the same things and so are motivated quite differently. The order in which different amounts of income satisfy needs is, roughly:

1. Basic necessities of life (food, shelter, clothes, and the like).
2. Necessities for health and education (doctors, choice of foods, and so on).

[1] J. B. Wolfe, "Effectiveness of Token-Rewards for Chimpanzees," *Comp. Psychol Monog.*, 1936, *12*, 77.

3. Luxuries (mostly acquired needs).
4. Social position.
5. Power.

The man who accumulates millions seeks power, and his need is real. Men in lower income brackets wonder why he should seek more wealth than is necessary for his bodily needs and comforts. They do not understand his motivation because they have not tasted the power and influence one may achieve with money. Many a man has said that he will stop working for money when he has obtained a certain amount. Such men failed to realize that they would develop other needs in the meantime and that these new needs would make them continue to struggle on. The chimpanzees learned only that poker chips bought food and water. They stopped working when they had accumulated a set of twenty or thirty chips.

The loss of money also produces a different kind of deprivation in rich and poor. The former lose power; the latter, food. The loss of power or social position directly affects the ego, and injury to the ego often drives a man to suicide. The poor man has less to lose psychologically. His ego is closer to earth; neighbors and relief agencies may keep his body intact.

That money represents the satisfaction of different kinds of needs becomes apparent if we speculate a moment on what men would do if they could not obtain social position and power by means of money. In such a case these needs would most readily be satisfied by service to society. The success of a man would become a matter of social, rather than financial, status. Instead of competing with each other for money chips, men would compete for other socially recognized indicators of merit. In the Bennington College Community, where liberal leanings became associated with prestige, the girls developed non-conservative values, the most capable leaders showing a greater degree of liberalism than the less capable ones.[2] Prestige is not neces-

[2] T. M. Newcomb, *Personality and Social Change*, p. 149.

sarily associated with wealth; rather, our social structure has given money a prestige value. The real factors are prestige and the experience of success. Making money thus becomes an aspiration, and, once it attains this status, we must continue to make money in order to avoid experiences of failure. With repeated success in the accumulation of wealth, the level of aspiration rises; as a consequence, there is no limit to the game.

Even with the prestige value which wealth has acquired among certain groups, many other groups are not predominantly influenced by it. Scientists are largely motivated by curiosity and many have undergone hardships and even persecution to satisfy this need. If such individuals seek prestige, it is the prestige in their particular group which counts. Reformers forgo remunerative positions to gain social position and influence by leading groups or social movements. A workman may take a job at lower pay in order to wear a white collar and gain prestige in his community. Even the businessman who insists that initiative in business cannot be attained without large profits will exert himself to the limit in a game of golf, thus demonstrating his responsiveness to other forms of incentive.

METHODS OF PAY AND THE VALUES THEY CREATE

Our economic structure is such that men are motivated to produce by the incentive of money, which, in turn, can be exchanged for real incentives. Wages and work thus go together. There are a number of possible methods by which wages may be distributed, each method having its unique effect on motivation and values. Since no single method is universally practiced, the effects in actual practice are mixed. A discussion of each method, however, will reveal its influence on behavior.

PAY IN TERMS OF PRODUCTION

Payment in terms of the amount produced motivates men to exert and improve themselves for purposes of the production of

goods. This method emphasizes individual differences, making superiority in ability a virtue. Efficiency and the production of goods become outstanding values, whereas culture and leisure come to be regarded as wasteful. Security tends to be a matter of individual responsibility, and the standard of living varies greatly among individuals doing the same kind of work. As strength and alertness decline with age, productiveness also declines. Respect for old age is not encouraged by this method of remuneration; the white-haired man in the shop is not treated with consideration and addressed with respect by the more productive generation.

If this method of pay were universally practiced, it would be necessary to establish formulae by which the value of one kind of work could be translated into that of another. How many units of production on a machine equals the productive value of the average supervisor or the engineer? By studying the rareness of abilities and the amount of training necessary for certain kinds of work, it would be possible to determine the relative values of different kinds of units of production. If this problem failed to be solved scientifically, it would tend to be resolved eventually by trial and error, since the supply of labor would drift to the relatively high-paying units of work, thus forcing up in value the low-paying units.

If pay in terms of production were practiced on a limited scale, it would encourage men of superior ability to seek jobs in plants using piece-rate pay methods and leave inferior men in plants using other methods of pay. To avoid friction within the plant, adjustments of pay rates would have to be made so that similar producing abilities yielded similar returns. A common practice is to reduce all production to standard units.

Although piece-rate methods use wages as an incentive to greater production, they do not necessarily motivate men to maximum effort. If morale is bad, superior men fear the reactions of average men, who do not like the unfavorable light in which they

are made to appear. Guarantees that the company will not change rates or discharge part of the men if production rises must accompany the scientific use of piece rates. When properly practiced, pay in terms of production is not opposed by labor. As a matter of fact, labor frequently supports such a program.

PAY ACCORDING TO TIME SPENT

The method of paying wages by the hour or the day fails to recognize the fact that there are individual differences in ability. One man can put in his time as well as another, so all men become equal. As a consequence, the superior individual is not encouraged to exert himself beyond the point of average production. Social pressure and the possibility of discharge might influence inferior workers, but these factors then become negative incentives. This daily-wage method wholly fails to use pay as an incentive to production, but uses it only to get men to report for work and put in their time.

To obtain any individual exertion, other incentives must be used; in actual practice, these are invariably present in one form or another. The policy of making promotions in terms of merit, for example, utilizes to some degree the principle of pay in terms of production. Bonus methods combine day wages with piece work. It is significant to note that bonuses distributed at the end of the year are too remote to be highly effective, for it is a well-known fact that the effectiveness of an incentive varies inversely with its remoteness. Similarly, bonus methods which divide the value of extra production equally among a group of workers are of limited value. In this case the man of superior ability must share his production with those of inferior ability. Only when the individual directly receives extra returns for his efforts does the bonus method properly introduce production pay as a supplement to day wages. An exception to this general principle arises when men are organized into a social group. Under such conditions men will exert themselves for the good of the group and thereby gain prestige in the group.

The method of payment by the day does not penalize old age. Neither differences in age nor differences in experience and ability influence pay; for this reason, older workers, as well as those who are less experienced and of inferior ability, favor it. In many ways, it promotes a kind of equality, but it is an artificial form of equality.

THE SENIORITY METHOD OF PAY

Payment of wages in terms of length of service makes long years of loyalty to a company a virtue. Under this system, old men would have an advantage, and young men would tend to look forward to and to honor old age. Thus, white-haired men would tend to be addressed with courtesy and veneration by the younger generation. This method of pay would offer security in old age and make man's declining years pleasant and comfortable. Individual differences in ability would not be recognized, since all men have the same ability to get older. Like day-wage procedures, this method of pay would not induce men to exert themselves unless other motivating factors were added.

Practiced on a limited scale, this method would cause young men of superior ability to seek employment in organizations in which ability to produce was a factor. The inferior men would remain in occupations where seniority pay methods are used, since they can wait for promotion as well as others. In a study of intelligence of employees in a police department, it was found that there was an inverse relationship between intelligence and rank, as well as between intelligence and length of service.[3] The new patrolmen on the beat were the most superior, and, after a few months of service, the more intelligent of these tended to drop out of the police service to seek work elsewhere. It is disheartening for men of superior intelligence to see inferior men promoted over them and to take orders from them. This gradual elimination of highly intelligent individuals apparently continued

[3] L. L Thurstone, "The Intelligence of Policemen," *J. Person. Res.*, 1922, *1*, 64–74.

so that finally the officers had to be selected from among those who were willing to wait. A similar condition probably exists wherever the seniority method plays an important part in promotion.

Seniority, if practiced universally, would not permit a superior man to go elsewhere to find a means to capitalize on his ability. As a consequence, he would either have to adjust and acquire other outlets for the expression of his abilities or live a life of frustration.

PAY ON THE BASIS OF NEED

None of the above methods takes into account the needs of a man. In actual practice, this factor is given some consideration. It is not uncommon for a man to receive a raise when he gets married, or for one man to be paid a little more than another because he has a larger family. If pay were determined purely on the basis of need, it would tend to equalize the standard of living of all people.

Since this method of pay would not encourage individual initiative, in this respect it would function the same as do the methods based on day rates or seniority. It would, however, tend to create security, for individual misfortune would become the responsibility of society. Raising children would be a social responsibility and would not be an economic problem for the parents. It may seem unreasonable to demand that childless people help to finance the rearing of the children of others, but it is just as unreasonable to demand that the children of some be called upon to go to war to save the country for childless people. If children can be called upon to serve the Government in war, it is reasonable to expect society as a whole to take the responsibility for the cost of their upbringing. As a matter of fact, some responsibility for rearing children is borne by the state. All people contribute to school taxes, regardless of the number of children they send to school. Congress also considered need as a factor in the rate of pay for soldiers of World War II when it introduced allowances for dependents.

THE METHODS IN PRACTICE

In actual practice, no one of the methods is used universally, and frequently they are combined in one form or another. Production is recognized by the fact that some jobs pay more than others. After taking this into account, pay is largely a matter of hours of work. To the extent that bonuses and promotions are based on merit, the production-pay method is again applied. Pay raises based on length of service are also given. It is argued that the average man increases in productiveness with training, but the fact remains that only some of the people are average. People who are above average in a particular ability are more valuable producers after a little training than are people who are below average after much more training. As a consequence, the real factor in schemes which give periodic pay raises is length of service or seniority.

It cannot be denied that recognition of length of service has value in reducing general turnover, but, if practiced too strictly, it creates turnover among the superior individuals. It is practiced most consistently in police and fire departments, civil service departments, school systems, and in the military services. In most instances the factor of ability is given some consideration, however. Since only those who have certain minimum abilities can qualify for the higher positions, a person cannot work to the top without satisfying certain requirements. Officer-training qualifications are specified in military services, and teaching positions demand minimum degrees.

Need is perhaps considered least of all, particularly in situations where employers and employees do not have face-to-face relations with each other. Such social values as "children are a personal responsibility" and "parents who haven't the means have no business having large families" are very commonly expressed. In recent years, this attitude of personal responsibility is on the wane, and there is an increasing drift in attitude toward government responsibility in establishing security for the needy.

THE PROPER METHOD OF REMUNERATION

The fact that all four methods of pay are actually in practice suggests that each one has a value for society as a whole. People of inferior ability, not recognizing their inferiority, make demands for decent standards of living. Superior individuals, who have higher levels of aspiration, make demands for higher pay for their extra services. Old employees feel justified in being rewarded for their accumulated wisdom, while men with large families demand more because they have to have it. We recognize and appreciate the justice in each of these demands because all these values have arisen in our society.

Since the values that exist in society cannot be completely ignored by industry, it follows that the best method of remuneration will depend on the values a given society wishes to perpetuate. Industry can influence these values by its method of remuneration, but it cannot arbitrarily decide on one method entirely to suit its own purpose and interests. Since values change gradually with the times, industry must take the existing conditions into consideration and further those trends in values which most effectively enrich life.

Pay in terms of production is the only method which utilizes pay for motivating all men to produce in accordance with their abilities. When there exists a demand for greater production, such as in time of war, it is the surest and most simple method of pay that can be used for obtaining increased production. When limited production is desired, the hours of work can be reduced so as to spread the work and create opportunities for culture and leisure. If employers were made responsible for maintaining full employment, the reductions in hours could be regulated without too much government control. Industry could then continue to improve its production methods without fear of dislocating labor. In times of crisis, it could always fall back on available man-hours to fill the gap, and manpower shortages would be reduced, if not entirely avoided. With the existing work-day, an increase in the

hours of work cannot be made without involving a loss in production because of fatigue, unless rest pauses are considerably extended.

To offset opposition to this method from individuals whose wages may thereby be lowered, it is necessary to compensate the low producers in some other way. A basic rate, with extra pay beyond average production, is a step in that direction. Another method is to set maximum pay rates and permit superior producers to go home after they have attained their quota or allow them proportionately more time off for vacations. As a matter of fact, the total production is likely to rise to such an extent that even the inferior workers will make more pay than they did before. If they failed to do so, special training might bring them up to the point where they can compete effectively.

Insurance methods would take care of security during ill health and old age. Government subsidies or substantial reductions in income taxes would take into account the size of the family and distribute the burden of rearing children.

By recognizing the values that already exist, it is possible to establish methods of remuneration which increase production by encouraging the expression of individual differences, and which, at the same time, do not conflict with the needs for social development and progress. The historical trend is in this direction. If industry fails to compete successfully in the world markets and, at the same time, does not abolish insecurity, then it must submit to government regulations or even to government ownership.

Leading industrialists are aware of their responsibility for creating jobs in the post-war era. According to Eric A. Johnston, president of the Chamber of Commerce of the United States, private enterprise is doomed if it cannot furnish employment quickly and permanently after the war. Such leaders frankly admit that some form of socialism will supplant the private-enterprise system if the latter fails to provide a stable economy.[4]

[4] C. H. Grattan, "What Business Thinks about Post-War America," *Harper's*,

PRACTICAL ASPECTS

The description of a psychologically sound wage policy does not yield a specific wage plan. A number of technical problems remain to be solved. If pay is based on production, one must be able to equate different kinds of production. How much production by a highly trained engineer is equal to a given amount of work turned out by a man operating a lathe? Even different kinds of lathe work must be equated. Thus, the differences in job classification must be considered and comparisons between jobs requiring similar degrees of technical knowledge must be made before a high degree of accuracy in pay rates can be achieved. The type of approach to the problem of equating jobs was suggested in Chapter 10.

Other technical difficulties arise when pay which is based on production is applied to non-production jobs. This problem requires a consideration of rating procedures, which were discussed in Chapter 7. Finally, one must distinguish between jobs in which the pace is set by a machine or a production line and jobs in which the pace is set by the worker himself. Sometimes it is possible to remove the limitations of a fixed pace in a production line by having several lines moving at different speeds and placing men on the lines that best suit their talents. In other cases the formation of small and large teams of workers will give small teams made up of superior workers an opportunity to express their special talents by keeping pace with larger teams of slower workers.

The above description of some of the difficulties shows that there is a considerable gap between a psychologically sound wage policy and its application to the industrial scene. Some of the problems can be worked out by the analysis of jobs; others require a consideration of the views and experiences of both management and labor.

Economic considerations, as well as the habits and prejudices of men, also enter the problem when application is considered. This means that wage plans will develop and change with the

times. A number of wage plans have been used; in many cases they incorporate a provision for rewarding the exceptional worker, as well as for giving a minimum rate to the slower worker. In such cases, the plan involves both an hourly rate and a premium piece rate. To promote interest in production and to encourage savings (for security), some plans allow the purchase of stock in the company. Other plans are designed to encourage production by sharing profits with employees. Profit-sharing plans vary according to the proportion of the total profits to be distributed, as well as with the distribution of the specified proportion among the employees.[5]

There is no one plan which can be considered the best, although some plans are superior to others. The same plan which may be effective for a commercial concern may be quite inadequate for an industry employing unskilled and uneducated workers. Similarly, changes in social legislation, economic security, and labor organizations alter the needs of employees, and wage plans must be changed accordingly. Because of these varying considerations, wage plans must be evaluated in terms of motivating conditions as they exist. A knowledge of motivation, therefore, is a prerequisite for the evaluation of such plans.

OTHER METHODS OF MOTIVATING THE WORKER

WORK AND PLAY

Some needs are satisfied by incentives which must first be produced. Food, shelter, and all industrial products must be created before certain needs are relieved. It is the production of these incentives which we call work. Play activity does not produce goods; instead, it satisfies certain needs directly rather than indirectly. Both play and work, however, require skill and effort, and, with respect to energy expenditure, they may be alike. Also both may be pleasant, and hence may serve as goals in them-

[5] D. Yoder, *Personnel Management and Industrial Relations*, chap. 13.

selves. Play and work activity differ primarily, in that the former has no external incentive value.

Men are more likely to engage in unpleasant work than in unpleasant play only because the former has the added financial incentive. This difference has led some to the erroneous conclusion that work is something unpleasant. Indeed, one is almost forced to believe that some employers strive to make work unpleasant, so that the employees will "earn their money." A little thought on this matter will show that man does not resist expending energy. Unemployment and retirement are often dreaded, even when loss of security is not involved. Businessmen frequently are in poor mental health after retirement; in fact, their mental condition often seems to contribute to a premature death.[6] Men should learn to play while they are still young, so that this activity can replace work when the latter becomes too strenuous for their energies.

If expenditure of energy is natural and healthy, it is apparent that every effort should be made to make work as pleasant as possible. Even if the method of remuneration does not bring to expression the differences in ability which exist in human beings, this effect can be attained, at least in part, by resorting to other methods of motivation. If increased wages are used to motivate, added incentives will increase output even further.

THE USE OF PRAISE AS AN INCENTIVE

Praise is a form of ego satisfaction, and adults as well as children can readily be motivated with it. Too often, reprimand is the more natural procedure. The "boss" tends to expect good work, so he neglects to comment on such behavior, but attacks errors because these frustrate him in his program of work.

A number of experimental studies have been made on the effects of praise and reprimand on the quality and quantity of work of college students. These results are combined and aver-

[6] K. Menninger, *Love Against Hate*, p 145

aged together in Table 4. It will be seen that praising their work produced improved work in 87.5 per cent of the students and resulted in poorer work in only .5 per cent. Various expressions of disapproval of work done caused from 11.9 to 66.3 per cent of the students to do better, the number varying with the form of disapproval, while poorer results occurred in from 10.7 to 65.1 per cent of the cases. It is clear that praise for past efforts is distinctly superior to any form of disapproval of the lack of effort previously expended.

Only one method of disapproval improves results more than it curtails them. This is private reprimand. All the other five procedures actually motivate people to do more poorly. It is significant to note that the negative incentives fail to yield the intended results in proportion to the degree to which they injure the ego. Reprimand, ridicule, and sarcasm injure the ego in the order named, and they produce progressively poorer results in the same order. Public disapproval is more degrading to the individual than is privately expressed disapproval; thus, in the case of each of the three forms of disapproval, the public form is more harmful in terms of improvement in work than is the private form.

Disapproval of results is undesirable not only because it attacks the ego, but also because it is negative in nature. It does not tell

TABLE 4. COMPARISON OF POSITIVE AND NEGATIVE INCENTIVES [7]

Incentive	Order of Merit	Percentage Showing		
		Better Results	*Same Results*	*Poorer Results*
Public praise	1	87.5	12.0	0.5
Private reprimand	2	66.3	23.0	10.7
Public reprimand	3	34.7	26.7	38.7
Private ridicule	4	32.5	33.0	34.5
Public ridicule	6	17.0	35.7	47.3
Private sarcasm	5	27.9	27.5	44.7
Public sarcasm	7	11.9	23.0	65.1

[7] Modified from H. Moore, *Psychology for Business and Industry*, p. 302.

people what to do, but rather what not to do. Praise is constructive and suggests that more of a particular kind of behavior be shown. Criticism should always be constructive and point the way to improvement. It is conceivable that, in some cases, it is difficult to find anything to praise, but even these will not warrant blanket disapproval.

COMPETITION

Competition is a motivating factor in most forms of play and is highly effective in sports. It can readily be used in work and often transforms unpleasant work into a game. Competition between equals produces better motivating conditions than competition between persons widely different in ability. It is often desirable to have a person try to better his own score. In this case, his old record becomes a real challenge because it is hard to surpass. Asking a person to beat his own record presupposes that he has a knowledge of his own results. It is for this reason that knowledge of results becomes an important factor in improvement.

In one experiment two groups of students were given a series of mental tasks requiring both accuracy and speed. One group was told to do its best; the other was told its results and urged to better them.[8] A total of a hundred and twenty tests were made on the two groups. The final results showed that the group in which the individuals had knowledge of their results did 16.5 per cent better than the group which was urged to do its best.

Similar results were obtained in an experiment which required students repeatedly to lift a weight by flexing a finger and to continue until the finger was exhausted.[9] Eleven such tests were made at intervals of forty-eight hours. When the subjects knew the number of lifts their efforts had produced on previous occa-

[8] W. F. Book, and L. Norvelle, "An Experimental Study of Learning Incentives," *Ped. Sem.*, 1922, *29*, 305–362.

[9] G. F. Arps, "Work with Knowledge of Results versus Work without Knowledge of Results," *Psychol. Monog.*, 1920, *28*, 41.

sions, they were able to make a greater number of lifts than when they had no knowledge of their previous scores.

Competition between groups of people is not as effective as competition between individuals because the responsibility is divided and the individual ego is not involved to the same degree. A good illustration of this is found in an experiment in which college students were given a reading test.[10] After first being tested, forty-five students were divided into three groups in such a way that the groups were matched for ability. The tests were then repeated. In one group, no competition was arranged, and this group did 8.7 per cent better on the second test than on the first. This improvement was undoubtedly due to practice. A second group was divided into two halves which were pitted against each other. This group improved 14.5 per cent. Considering that practice accounted for 8.7 per cent, this leaves only 5.8 per cent of the improvement attributable to competition. The individuals in the third group were individually asked to beat the record of some other person in the group. This group improved 34.7 per cent, of which 28 per cent may be attributed to competition. It is clear that in this instance individual competition surpassed group competition.

It is probable that group competition can be utilized with considerable effectiveness if the groups are formed into teams. The development of team spirit increases the responsibility of each individual and introduces the element of social pressure. In such cases it is desirable to have the abilities well matched within the group so that there is a minimum tendency for a few members to be made scapegoats.

Production measurement, of course, is a prerequisite to the introduction of competitive methods in industry. When possible, individual production should be measured in such a way that each person can have knowledge of his own record so that he can com-

[10] V. M Sims, "The Relative Influence of Two Types of Motivation on Improvement," *J. Educ. Psychol.*, 1928, *19*, 480–484.

pete with himself or his equals. When production units are the work of groups or teams, the members of a team should be carefully selected with regard to ability and congeniality. It is good policy to permit the men to have a voice in the selection of team mates in order to avoid dissension.

Competitive methods have been utilized successfully in industry. Invariably, the results support the laboratory findings. Precautions should be taken, however, so that quality of work does not suffer.

GROUP DECISIONS IN SETTING PRODUCTION GOALS

When production is a matter of co-ordination of group activity, production can be increased by stimulating the group to decide on a goal. In such cases the goal set should be unanimously approved. In an industry in which piece-rate methods of pay were used and the jobs had all been efficiently set up by time and motion analysis, production was further increased by the method of group decisions.[11] A co-ordinating group of workers held three brief weekly meetings with the psychologist in the plant for the purpose of deciding on a definite production which they could attain within a certain time. The goal decided upon in the first meeting was to get production up to 84 units per hour within five days. Up to this time, 60 units was standard and 75 was supposed to be the ceiling. Nevertheless, the goal was reached. At the next meeting, the goal was set at 95, but this figure was not reached. At the third meeting, the group decision was to hold the hourly production at 90 for five weeks. Actually, the production has been stabilized in the vicinity of 87 units per hour. These results are graphically shown in Figure 17.

In order to determine whether the increase in production was caused by the group decision or some other factors asscciated with

[11] This material has been made available through the courtesy of Alex Bavelas, who is conducting the industrial research in connection with a program instituted at the University of Iowa under the direction of Professor Kurt Lewin.

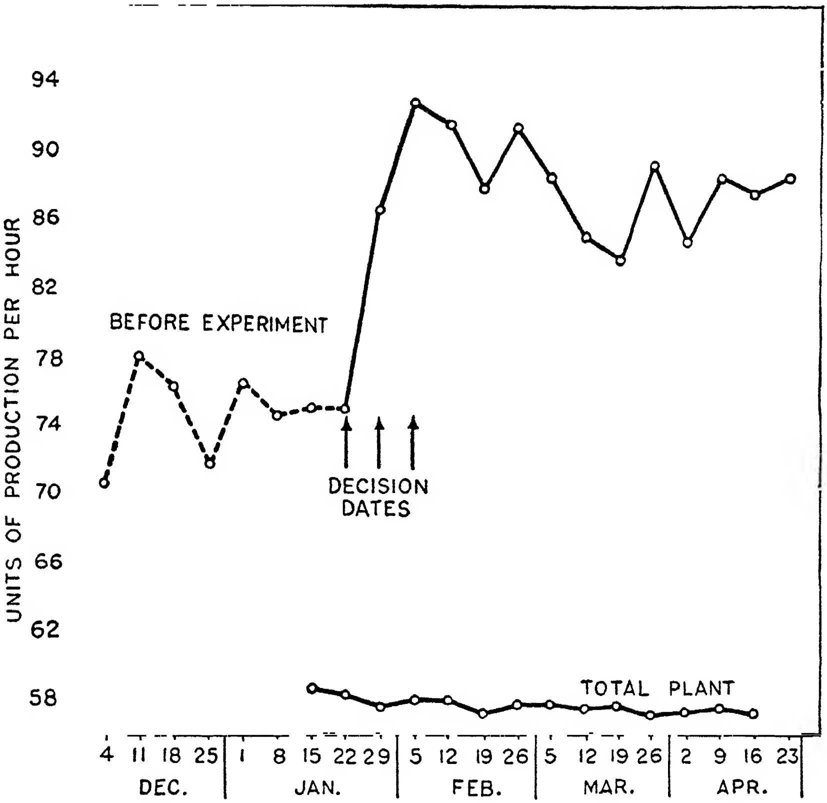

Figure 17. Effect of Team Decision

When a team of workers decided to attain a specific goal, their production showed a sharp increase, which was maintained, despite the fact that the team's performance was already above the average of the plant. (Courtesy of A. Bavelas.)

the group meeting, two other working teams held interviews with the psychologist. They received the same attention and friendly encouragement, but no production goal was decided upon. The two curves of Figure 18 show the production records of these two teams. There is no evidence to indicate that production was favorably influenced by holding meetings when no group decision was made. The place marked "double assurance" on the curve indicates the date on which both groups were reassured that any

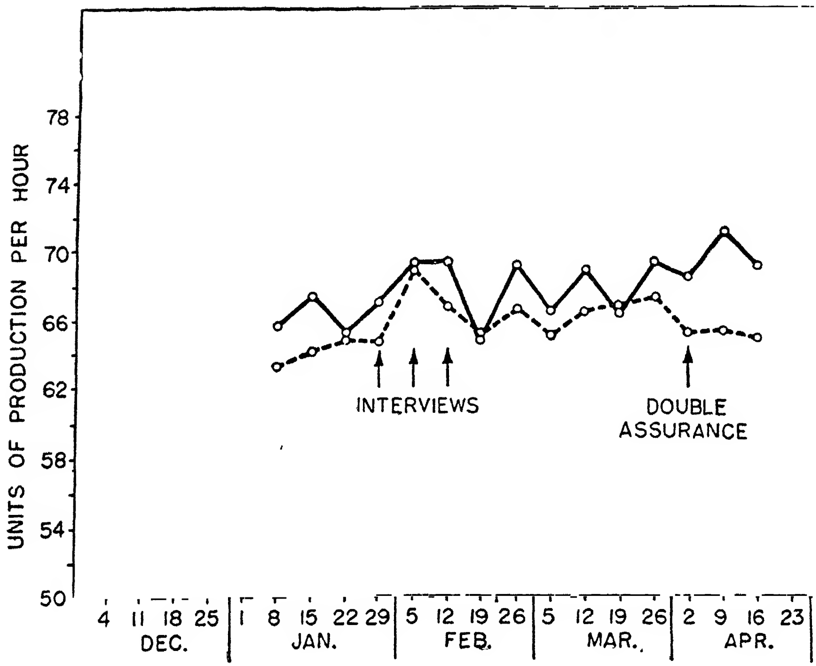

Figure 18. Effect of Team Discussion Without Decision
Two teams hold discussions but do not decide on a specific production goal. The discussions alone have little if any effect on production. (Courtesy of A. Bavelas.)

increase in production which they achieved would neither influence the piece rates on which they were paid nor set a new standard which they would be expected to maintain. Significant, also, is the fact that a request by the psychologist to produce a certain amount had little effect. Only when the psychologist led the group to make a group decision did the startling increase in production occur. Group decision thus becomes an extremely important factor in determining the performance of a team of workers. It increases production under conditions where it would be impossible to claim that workers were holding back in their production. This method must be credited with doing more than increasing the *will* to produce.

WHAT WORKERS WANT IN THEIR JOBS

The importance of non-financial factors in work is borne out by a number of investigations on employee-wants. In one study, 325 women factory workers in England were asked to arrange ten items in order of their importance.[12] High pay was found to be only the sixth in importance. More important items were steady work and factors dealing with working conditions. In a similar study of 100 department-store employees and 150 miscellaneous workers, it was found that the item of good pay was sixth and seventh for the two groups, respectively, in a list of twelve factors.[13] Opportunities to advance, to use their own ideas, and to learn, as well as steady work, were rated higher than good pay by these groups. Non-selling employees of a merchandising organization placed good pay in the twenty-first position in a list of twenty-eight items.[14] Factors having to do with fair and considerate treatment tended to characterize the items thought to be the more important.

In a comparison of union and non-union workers, the amount of pay tied with working conditions for fourth place in a list of fourteen items among union employees and was in second place for non-union employees.[15] The two groups of men differed to a marked degree on three items only. Union employees regarded fair adjustment of grievances and safety as highly important and put them in first and third places, respectively; whereas non-union employees put these items in the seventh and ninth positions. Chance for promotion was given third place by the non-union employees and sixth place by the union men.

Since comparable items appear in many of the studies, it is

[12] S. Wyatt, J. N. Sangdon, and F. G. L Stock, "Fatigue and Boredom in Repetitive Work," *Indus. Hlth. Res. Bd*, 1937, Rep. 77, pp. 43–46.

[13] S. N. F. Chant, "Measuring the Factors That Make a Job Interesting," *Person. J.*, 1932, *11*, 1–4.

[14] J. D Houser, *What People Want from Business*, p 29.

[15] R. B. Hersey, "Psychology of Workers," *Person. Jr.*, 1936, *14*, 291–296.

possible to combine the results of the various studies in a single table. In Table 5, the choices of five different groups of workers are presented. It is apparent that these choices vary considerably from group to group. It is significant, however, that steady work (security) is a highly important item for all groups. Good hours and easy work, on the other hand, are relatively unimportant, making it clear that workers are not interested in shirking responsibility. They are willing to do a good day's work, but they demand fair treatment and reasonable opportunity to improve themselves.

Many items vary in importance, depending upon the conditions under which the employees are working. The desirability of a good boss is apparent when one does not have one. If promotions are made without regard to ability, then this factor becomes the basis of a grievance. Women apparently feel the need for good working conditions and congenial working companions more than do men. It is particularly important to recognize this sex difference with the increase in the number of women in industry.

TABLE 5. ORDER IN WHICH CERTAIN FACTORS APPEAL TO DIFFERENT GROUPS OF WORKERS

	Factory Workers (women)	*Department Store Workers*	*Miscellaneous Workers*	*Union Workers*	*Non-union Workers*	*Average*
Steady work	1	2	2	1	1	1.4
Comfortable working conditions	2	8	8	3.5	5	5.3
Good working companions	3	7	7			5.7
Good boss	4	5	5	7	6	5.4
Opportunity for advancement	5	1	1	6	4	3.4
High pay	6	6	6	3.5	3	4.9
Opportunity to use your ideas	7	3	3.5	10	10	6.7
Opportunity to learn a job	8	4	3.5			5.2
Good hours	9	9	9	8	8	8.6
Easy work	10	10	10			10

One may well ask why men strike for higher wages and shorter hours when these are not the items of greatest importance. The answer, in part, seems to be that, if work is going to be unpleasant, men will demand extra financial incentives to offset the undesirable conditions, and they will demand shorter hours so that they can escape the unpleasantness for as long a time as possible. Another factor in the demand for more pay is a desire for fairness. Men usually demand wage increases when the company can afford them. Their wish for fairness is, in part, an unwillingness to be exploited.

MOTIVATION AND ITS RELATION TO SPEED–UP METHODS

In our discussion of efficient work methods, it was pointed out that speed-up methods are designed to increase production by inducing workers to expend more energy. It is apparent that the methods of motivation discussed in this chapter could function as speed-up procedures. In so far as increasing the incentive to produce results in excessive energy expenditure, it gives rise to excessive fatigue, a condition which, as we shall see in the next chapter, lowers efficiency in the long run. It is apparent, therefore, that there is an optimum energy expenditure. Since this optimum varies from individual to individual, each worker should be motivated to expend his energy to the optimum degree and to co-operate in learning the best methods of work. Such motivation can be accomplished by incentive methods, the purpose of which is to get men to produce in accordance with their abilities. These methods should discourage the wasting of energy for the sake of looking busy, a type of behavior which is likely to be found in superior individuals, as we have already pointed out. They should likewise discourage those of lesser ability from attempting to produce at levels exceeding their abilities. This problem will be reconsidered in the next chapter. An indication of excess energy expenditure becomes apparent when a man cannot maintain a work pace day after day. As long as production

increases, resulting from incentive methods, can be continued over a period of time, and health is not impaired, it is probable that diminishing returns have not set in.

In conclusion, it may be stated that incentive methods should be used to increase the *will* to work effectively, but not painfully. A good personnel system would soon discover whether the added motivation served to create the unpleasant experience of being hurried or of "working against time." Another function of motivation is to encourage men to want to improve themselves by increasing their skills and by learning more effective work methods. There are no possible undesirable effects from these functions of added incentives. Finally, motivation should serve to make the individual differences in production show the same range and variation as the individual differences in ability. In order to keep fatigue at the proper level, all men should exert themselves to similar degrees and produce in accordance with their abilities.

14 FATIGUE

INTRODUCTION

For practical purposes, fatigue may be defined as *a reduction in the ability to do work because of previous work.* This definition does not attempt to describe the nature of fatigue, but rather uses the result as its criterion. As soon as we attempt to determine the nature of fatigue, differences in opinion arise, for it is highly probable that the reduction in ability to do work is caused by a variety of changes, ranging from the chemical to the psychological. Previous activity of a particular part of the body alters its ability to continue to function, and some of the changes produced by this activity can be specifically localized.

We may also approach the problem of fatigue by studying the "feelings" of the fatigued person. When a man says he is tired out, to what extent is he describing the localized changes that have taken place in his body? If the physiological changes always corresponded with the psychological experiences, it might be supposed that the two approaches measure different aspects of the same thing. Unfortunately, the various evidences of fatigue do not always agree. On the one hand, a person may "feel" completely rested, but his work record may show a rapid decline. Under conditions of strong motivation, men may continue work for long periods of time without being aware of fatigue, whereas, under other conditions. they may feel fatigued before they begin to work.

There is every reason to believe that the attitude of an individual is an important factor in the ability to do work, but the presence of this attitude cannot be detected by any physiological measures known at present. In Chapter 3 we pointed out how attitudes influence productivity and how these tended to cover up the expected effects in experimental studies dealing with the influences of rest periods on work. Any study of fatigue must control, not only the actual physical activity, but also the indefinite environmental factors which influence a man's outlook and attitude toward the work as well. It has recently become apparent that emotional stability and mental hygiene cannot be divorced from fatigue, since emotional conflicts and attitudes are so closely related to fatigue that the latter cannot be defined without involving the other factors.[1] To the extent that fatigue involves the organism as a whole, it is a psychological problem. To the extent that work produces chemical and physiological changes, the problem is the concern of both biological chemists and physiologists.

Despite the complexity of the problem, it is worth while to examine some of the specific causes of work decrement. Any progressive change which is caused by energy expenditure and which can be localized in the body obviously affects the psychological functions. At the same time, an analysis of such changes throws light on the variety of conditions which influence a reduction in ability to do industrial work.

THE LOCATION OF FATIGUE

By studying the function of isolated parts of the body, it is possible to demonstrate the existence of changes produced by activity in these parts. This approach obviously does not give the true picture of fatigue in man as a whole, but it does throw light on some of the factors which are involved in the complex

[1] S. H. Bartley, "Conflict, Frustration and Fatigue," *Psychosom. Med.*, 1943, *5*, 160–163.

nature of fatigue. The error made in the past was the supposition that particular localized changes told the complete story.

THE MUSCLE

A piece of muscle removed from an animal can be caused to contract repeatedly by applying electric shocks to it. If the degree of contraction is measured by the tension the muscle exerts on a spring, it is found that the vigor of the contraction gradually diminishes as stimulation is continued. Finally, a stage is reached where the muscle completely fails to respond. This demonstrates that the functioning of a muscle can be completely abolished by its own action. Another aspect of the action of the isolated muscle is its failure to relax completely after each contraction. It is believed that this inability to relax is produced by the substances formed by the chemical changes associated with contraction and that these chemical substances may be the basis for muscle cramp. Inability to relax, as well as inability to contract, thus characterizes a muscle which has been overstimulated.

If the unresponsive muscle is allowed to rest, or if the muscle is washed in a mild solution of salt water (one per cent of saline solution), the contractions reappear. This clearly shows that the loss in the ability of a muscle to contract is localized in the muscle, so we may speak of this form of fatigue as a purely muscular condition.

In the above instance, muscular contraction is associated with chemical changes in the food substances stored in the muscle. Lactic acid and certain waste products or toxins are formed in the process. In the intact animal, the blood supplies the food and oxygen and also carries off the waste products and carbon dioxide. The loss in irritability in the muscle may be caused by deficiencies in any of these chemical changes. As the supply of food (glycogen) is depleted, the contractions diminish. Likewise, an accumulation of waste products interferes with the muscle's responsiveness. Washing removes waste products and supplies the oxygen, whereas

rest makes oxygen from the air available and permits chemical changes associated with recovery to take place. The failure of the muscle to relax completely after a number of contractions is caused by the irritating effects of the chemical substances formed during the contractions. In the intact animal massaging removes the muscle cramp because it stimulates circulation, which, in turn, oxidizes or carries off the irritating chemical products.

THE NERVE

The responsiveness of a nerve may be studied by removing from an animal a muscle with a piece of nerve attached. Applying electric shock to the nerve now results in muscle contraction. With continued stimulation of the nerve-muscle preparation, the contraction of the muscle is soon abolished. If stimulation is then applied directly to the muscle, contractions will again occur. These contractions, however, are less than half as vigorous as those obtained when the muscle is not previously activated by way of the nerve.[2] Because the muscle can still function after stimulation of its nerve fails to produce action, there is reason to believe that the nerve protects the muscle from exhaustion. In so far as the nerve interferes in this manner, we must attribute part of the reduced function in the nerve-muscle preparation to changes which have taken place in the nerve. Although the nerve continues to be functional after repeated stimulation, it does not preserve its ability to excite the muscle. The changes which take place in the nerve thus serve to block muscular responses without a cessation of activity in the nerve itself.

Other evidence which shows that the nerve tissue falls to a low level of activity after continuous stimulation is obtained by measuring its metabolism.[3] A nerve stimulated intermittently (for twenty-two seconds every four minutes) uses three times as

[2] G. L. Freeman, *Introduction to Physiological Psychology*, pp. 503–512.

[3] R. W. Gerard, "Studies on Nerve Metabolism; II, Respiration in Oxygen and Nitrogen," *Amer. J. Physiol.*, 1927, *82*, 381–404.

much oxygen as one which is stimulated continuously over the period. If continuous nerve functioning consumes less oxygen than intermittent functioning, then we must conclude that the activity during the former condition must be at a lower level than that during the latter condition. As the activity of the nerve descends to a lower level, it becomes less responsive and less able to activate other tissues.

Although the lowered nervous function may be explained by a reduction of the oxygen supply in the nerve, the changed condition is nevertheless produced by previous activity and contributes to the general condition of work decrement. The frequent claim that nerves cannot be fatigued thus hinges on one's definition of fatigue.

Sense organs also become less responsive after a period of stimulation. This is particularly apparent with the sense of smell. We say we get used to an odor, but actually our olfactory sense becomes less acute. Similar changes occur in other sense organs, but the reduction in sensitivity is not so rapid. Nevertheless, the reader may have noticed that intermittent noises (which permit recovery) are more disturbing than continuous ones. A reduction in the sensitivity of sense organs is known as adaptation; its effect is to protect the organism from excessive stimulation.

THE BLOOD

That evidences of fatigue are to be found in the blood stream is shown by experiments in which the blood of a fatigued animal is injected into the blood stream of another. An unfatigued animal shows the symptoms of fatigue after such an injection. Extracts from a fatigued muscle (when injected into the blood) also produce fatigue symptoms in an animal. Experiments of this type show that the blood stream not only serves to remove the fatigue products from fatigued parts of the body, but that it may also distribute them to other parts. It is likely that their distribution to other parts of the body occurs only when there is an excess of

fatigue products, a condition which occurs when the rate of their formation exceeds the rate of recovery. The fact remains, however, that because of the blood stream the phenomena of fatigue becomes general and is not limited to the actual part of the body which is being exercised. A change is not so effective as a rest when physical activity is involved.

THE BRAIN

The experience of fatigue is perhaps caused both by sensations from the fatigued muscles and by the effects of the fatigue products which are carried by the blood stream. However, such conditions as boredom occur when there is little reason for believing that these factors are operating to an appreciable degree. In the next chapter, we shall consider the problem of boredom and monotony in greater detail. For the present, it should be pointed out that one may "feel" physically tired after a period of strenuous physical activity and that this condition is undoubtedly attributable to the effects which we have described. Of interest, however, is the fact that these sensations can be altered by a change in motivation.

The end spurt which frequently occurs as one approaches a goal or the end of a day's work is an example of the effects of a change in motivation. One may also speed up work to finish a task, despite the fact that muscular fatigue would call for a slowing-down. When it appears that a change is as good as a rest, the restfulness of the change is largely psychological. Even a change in instructions, such as requesting a person to lift the weights placed on both his hands instead of continuing to lift only the weight in the right hand, will partly restore the activity in the fatigued right hand.

These illustrations suffice to show that any consideration of fatigue cannot ignore the contribution of the brain. It is quite unlikely that psychological and physical fatigue are separate processes; both must be considered parts of the complex nature of fatigue.

ERGOGRAPH STUDIES OF FATIGUE

METHODS OF MEASUREMENT

The work of Angelo Mosso, an Italian scientist, has become one of the classics on the subject of fatigue. He developed an instrument, known as the *ergograph*, which made it possible to investigate the relation between fatigue and work in a relatively isolated part of the body. By studying the activity of a limited muscle group, he was able to induce fatigue in a short time. Thus, he could study the phenomenon without complicating it greatly with such psychological effects as monotony and boredom, which are likely to accompany longer periods of work.

The principle of the ergograph is simple. The arm is strapped to a frame in such a way that it is kept comfortable but immobile. All fingers except the middle one are likewise fastened to prevent their activity. A string is then fastened to the free finger, which is to be put to work. By placing a load on the other end of the string, the free finger can be made to pull against the load. In Mosso's apparatus, the string led over a pulley near the edge of the table and a given weight was fastened to it. In modern versions of the apparatus, the finger pulls against a known spring tension. The work of the finger is done by contracting and relaxing the muscles, which, in turn, lift and lower the weight. Different rhythms of work are studied by having the finger contractions follow a pattern laid down by a metronome. Since the frequency of contractions is important, this factor must always be carefully controlled.

In order to obtain a graph of the work output, a recording device is fastened to the moving string. Each contraction carries a needle over a revolving drum which records the magnitude of successive contractions by a series of straight lines.

RESULTS OBTAINED

The use of the ergograph has established a number of important

relationships, each of which has definite applications to industry. Nine specific principles of fatigue are briefly summarized in the following paragraphs.

(1) If the contractions with a given load are spaced one every two seconds or thereabouts, there is a gradual decrease in the amplitude of the contractions until finally no further contractions can be made. With a six-kilogram load, this stage is reached in about one minute. Reducing the load, however, will again permit contractions, but fatigue for this load is soon complete.

(2) If the contractions for the same load are spaced at long enough intervals (ten seconds, for example), there is no apparent evidence of fatigue. A six-kilogram weight can be lifted almost indefinitely under these conditions.

(3) If work is measured in terms of the total weight lifted through a given space, the amount of work which the finger is capable of doing is greater for light than for heavy loads. Thus, a three-kilogram load can be lifted definitely more than twice as often as a six-kilogram weight.

(4) Similarly, a given load lifted in a fast rhythm produces more fatigue than the same load lifted at a slower rhythm.

(5) The time for complete recovery (that is, until the previous performance can be duplicated) increases rapidly as the period of work is increased. For example, the recovery time for sixty contractions may be as long as two hours, whereas the recovery time for thirty contractions may be thirty minutes. After the stage of complete inability to move the finger is reached, efforts to lift the weight produce more fatigue (in terms of recovery time) than do the actual lifts which have previously been made. Generally speaking, the fatigue effects of each effort to contract increase rapidly as fatigue accumulates.

(6) The activity of other sets of muscles reduces the ability of the finger to do work. Strenuous exercise preceding the test with the ergograph causes the stage of complete inability to lift the weight to appear more quickly than normally. Thus, the ergo-

graph studies bear out the previously stated finding regarding the distribution of fatigue by way of the blood stream.

(7) The ability of the muscle to do work is decreased by loss of sleep, mental activity, hunger, and anemia of the muscles. As a matter of fact, any condition which depresses or interferes with the nutritive state increases the susceptibility to fatigue.

(8) The ability of the muscle to do work is increased by massaging the muscle, injections of sugar into the blood stream, good health, and a well-nourished body.

(9) The rate of fatigue differs greatly in different people, but all persons are alike, in that the principles which we have listed above apply to each of them.

APPLICATIONS OF ERGOGRAPH FINDINGS

ENERGY EXPENDITURE

The first five points listed in the previous section all support the general conclusion that, with a given amount of muscular energy, more work can be done when this energy is spent gradually than when it is spent rapidly. In this respect, the spending of muscular energy is like the spending of any other kind of energy. For example, more mileage is obtained from a gallon of gasoline if a car is driven at low speeds than if it is driven at high speeds, and more usable heat is obtained from a home heating plant when coal is burned uniformly and slowly. We have already pointed out how learning effort is most effective when it is spaced. There is a tendency, however, for a man to work fast when he has a lot of energy available. This tends to influence his work performance, causing him to be extremely wasteful of his energy. Just as long-distance runners have to learn to keep down their speed and adjust themselves to a pace that they have learned they can maintain, men in industry must be taught to spend their energy efficiently.

Another problem in the economical expenditure of energy lies in the fact that it is unnatural for a man to rest before he is fatigued to an uncomfortable degree. Since recovery time in-

creases rapidly as fatigue progresses, it is advisable for a workman to rest before fatigue has progressed very far or to work at such a pace that rest periods are unnecessary.

The potential application of this principle can be made very dramatically by giving a man the job which requires him to lift a six-kilogram weight in the ergograph and having him do this work under three different conditions.[4] Under the first condition the man must make one contraction every two seconds and continue work until he is unable to lift the weight. He is then allowed to rest until fully recovered. By this procedure, the man can make thirty contractions and must then rest two hours in order to recover. In an eight-hour day, the man would be able to do four sets of thirty contractions, or a total of one hundred and twenty.

Under the second condition, the man must rest after fifteen contractions. When he follows this pattern, only half an hour is necessary for recovery. In an eight-hour day, the man could now do sixteen sets of fifteen contractions, or make a total of two hundred and forty contractions. Thus, by taking his rest period a little sooner, he doubles his number of contractions.

Under the third condition, the man is asked to pause ten seconds between each contraction. This pace is so slow that fatigue does not become apparent. Allowing, now, two seconds for contractions and ten seconds for rest, each contraction would consume twelve seconds. At this pace the man could do three hundred per hour or twenty-four hundred contractions in a day. His accomplishment is now twenty times as great as it was under the first condition.

Undoubtedly, such a difference would not be obtained in practical work conditions because this experiment deals with a very limited muscle and one which is completely exhausted under the most unfavorable conditions. Neither of these conditions prevails in industry. However, the illustration clearly demonstrates

[4] B. Muscio, *Lectures on Industrial Psychology*, pp. 85–88.

the importance of reducing fatigue, and, even if an increase in production of no more than fifteen per cent were obtained in industry, it would be highly significant.

It has already been pointed out how the motion and time studies have utilized some of the ergograph principles by spacing or spreading the work. Gilbreth was a strong advocate of fatigue elimination, and much of his effectiveness was attributable to his recognition of the fatigue problem. In motion and time studies, fatigue was reduced by (1) lightening the load, (2) introducing rest periods, and (3) pacing the work. Since any one of these methods serves the same purpose, the procedure which is adopted depends on the nature of the work.

In analyzing the work of shoveling, it was found that the amount of material handled was greater when small shovels were used than when large shovels were used.[5] There is a most efficient shovel size for each kind of material which is so handled. Although this size varies for different individuals, a size which best suits the average workman can be found. Since large shovels produce fatigue rapidly, they are inefficient. Small shovels induce fatigue slowly, but they transport little material in comparison with their own weight. Since production is measured by the amount of material handled and not by the weight lifted (shovel plus gravel) a shovel may be so small that it fatigues without producing results. Between the two extremes, there exists a shovel size which fatigues most slowly for the amount of material handled. The same applications may be made to other kinds of work. There is a most efficient hoe size for farmers, a most efficient hammer weight for carpenters, and a most efficient load for hod-carriers.

On jobs in which the load to be handled is fixed, men may work in pairs. For example, two men can handle more heavy lumber by working together than by working individually; at the same time, they are less likely to injure each other.

[5] F. W. Taylor, *The Principles of Scientific Management*, pp. 64–69.

When it is impossible either to reduce the load or pair the men, periodic rest periods can serve the purpose of reducing fatigue. This was the procedure used in the handling of pig iron.

Much industrial work does not involve heavy loads, but instead requires rapid movements. In some cases the movements may be paced; in other cases rest periods should be imposed so as to distribute the work properly. Although the best procedure for setting the pace of a production line has not been determined, it is probable that it should be fairly constant throughout the day, except during the first half-hour, when it should be slower to permit "warming up." It is a fairly common practice to have the line move most rapidly in the early part of the day and to slow it down as the end of the work period is approached. This procedure is definitely contrary to the principles of fatigue. It is based upon the mistaken belief that men should spend their energy when they have it available. Actually, it requires men to spend most of their working time in a fatigued condition.

THE GENERAL CHARACTERISTIC OF FATIGUE

The sixth point of the ergograph results indicates that fatigue is general in nature. If activity of one set of muscles reduces the ability of others to do work, then recovery must proceed most effectively when the person is completely relaxed. This suggests that work pauses for heavy muscular activity should be not only work stoppages, but periods of complete relaxation. Comfortable lounges might be made available for use during the lunch hour, and comfortable seats might be readily accessible during rest periods. Properly located drinking fountains would also help to conserve energy. Unfortunately, workers who have the most strenuous occupations too often have the least accessible facilities for relaxation.

HEALTH AND NOURISHMENT

The seventh and eighth points of the ergograph results deal with

the healthful state of the body. They suggest that an employee's living conditions outside the plant play an important part in his ability to work. Some of these conditions can be improved by adequate remuneration; others, by educational methods.

Services which reduce or eliminate causes of worry among employees are frequently introduced by progressive establishments. Such services include loans, hospitalization, and legal advice, all of which are made available to the employees at greatly reduced costs.

Since food intake reduces fatigue, it may be considered as a practical substitute for, or addition to, rest. Company restaurants that sell good food at low prices encourage healthful eating habits and are sound investments. When employees carry lunches, their diet is often inadequate; when they use the lunch hour for shopping and getting sodas at a drugstore, they fatigue themselves and come back to work improperly fed. On the other hand, when employees eat at a company restaurant which is attractive and serves good food, they enjoy the noon hour and are properly nourished. Not only does such a program permit recovery from fatigue and prevent further fatigue, but it helps to build up a favorable attitude toward the company. It follows, further, that if the intake of food eliminates or reduces fatigue, it may be advisable to serve refreshments during the morning and afternoon work periods. Later in this chapter, this point will be considered again.

INDIVIDUAL DIFFERENCES

The last point in the list of ergograph results brings out the factor of individual differences. Some people become fatigued more readily and require more time for recovery than do others. For this reason, individual differences in the work pace that can be maintained should be recognized. When men work in teams and are dependent on one another, it is advisable to match their susceptibility to fatigue as well as their ability. Men should be

This writer has no knowledge of a firm which has encouraged men to take time out for smokes and rest pauses or has permitted lunching during working hours and found the practice anything but desirable. One author reports a 10 per-cent increase in production after two extra meals were given to employees.[7] The employees also reported that they felt less fatigued, despite the increased production. In some instances employers have found it worth while to furnish comfortable chairs and cots so that complete relaxation might occur during rest pauses. Although controlled experiments on many of these points have not been made, favorable results may be expected. The fact remains that men will find opportunities for rest whether or not these are permitted. Unauthorized rest periods force men to hide in washrooms; under these conditions they are unable to relax properly. In one of the largest war industries in the United States, the men obtain a good deal of free time by waiting in line for the washroom. Inadequate facilities of this sort offer opportunities for unauthorized rests, but such rests do not actually give the employees the benefits of a rest period. Standing in line is hard work.

With the mass employment of women in war industries, many of the obviously fatigue-reducing reforms have been forced upon management. Company restaurants, rest periods, attractive and comfortable restrooms, protection against hard cement floors, and stools have been adopted to keep women employees from quitting. Invariably, these changes have been found to pay dividends in increased production.[8] In one instance just the installation of stools for women increased production 32 per cent.

The reasonable approach to the problem is that of experimentally determining the optimal conditions for rest and nourishment for different kinds of industrial work, as well as for men and women, and then arranging the work programs in accordance

[7] W. W. Haggard, "Work and Fatigue," *Mech. Engin.*, 1936, *58*, 298–301.
[8] A G Mezerik, "The Factory Manager Learns the Facts of Life," *Harper's*, 1943, *187*, 289–297

with the findings. Evidence from typical industrial studies will be presented in later sections of this chapter. Before considering the more practical questions, we shall turn to a consideration of the nature of the effects of fatigue on industrial work. The effort which should be taken to eliminate fatigue naturally depends upon how pronounced and general the effects are under existing working conditions.

HOURLY ACCIDENTS AS A MEASURE OF INDUSTRIAL FATIGUE

A study of industrial accidents in terms of the hour of the day at which they occur shows a consistent increase during both morning and afternoon periods.[9] A comparison of accident data from all of Germany, the state of Illinois, and Lancashire, England, shows almost identical trends. Although these surveys neither take into account the number of men at work during a given hour nor differentiate between the types of work, certain comparisons are valid. It is reasonable to suppose, for example, that from eight to eleven in the morning and from one to four in the afternoon comparable numbers of men are at work. The data given in Table 6 show very similar increases in accidents both in the morning and afternoon work periods.

An analysis of the data for specific industries shows that a similar trend occurs for a variety of industries, ranging from printing to the cotton and metal industries.[10] The morning trend is found to be upward, but frequently there is a drop in the last hour. The afternoon trend is less consistent and shows more variations in different industries. Although the accident rate of the afternoon period, in most instances, begins at a higher point than that of the morning period, the total number of afternoon accidents does not exceed the morning total. Differences in the afternoon and morning trends, as well as the fact that night shifts do not show the same accident trend as day shifts, indicate

[9] Muscio, *op. cit.,* pp 55–58.
[10] H. M. Vernon, *Accidents and Their Prevention,* p. 66.

TABLE 6. INCIDENCE OF ACCIDENTS AT VARIOUS HOURS OF THE DAY
(From Muscio)

Hour of Day	Percentage of All Accidents		
	Germany 1887	*Illinois* 1910	*England* 1908
8– 9	6 6	5.6	5 7*
9–10	8.6	9.1	6.7
10–11	12 8	11.5	12.0
1– 2	6 0	5 2	4.0 *
2– 3	8 4	7 3	6 0
3– 4	10 0	10.7	9.7

* These figures are based on a half-hour period

that, although fatigue is an important cause of industrial accidents, the accident curve is not an accurate picture of the fatigue curve.

The accident studies also reveal that fatigue is a greater contributor to accidents among women than among men.[11] This probably means that accidents are primarily associated with excessive fatigue. Undoubtedly, fatigue influences people in different ways so that some individuals compensate by slowing down, becoming cautious, or taking rests; whereas others become inattentive or fall asleep. The fact that fatigue and accidents are

[11] Vernon, *op. cit*, p 68.

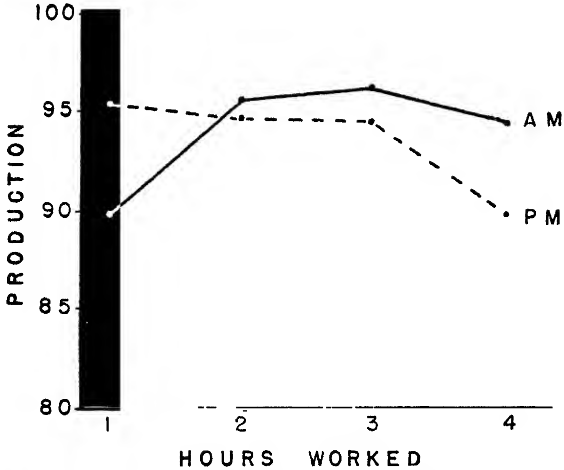

Figure 19. Production Curves for Morning and Afternoon Work Periods
The solid line indicates production during the four hours of the morning and the broken line indicates production during the four afternoon hours. The warming-up characteristics are absent in the afternoon period, but the fatigue effects are more apparent than in the morning period.

related, however, must be recognized as one of the important reasons for fatigue elimination.

HOURLY PRODUCTION AS A MEASURE OF INDUSTRIAL FATIGUE

CHARACTERISTICS OF THE PRODUCTION CURVE

When the amount of production is left largely to the individual and is not paced by the speed of the production line, hourly production gradually falls off both during the morning and afternoon work periods. Typical production curves for morning and afternoon periods are shown in Figure 19. The work on which these curves are based is classified as medium heavy.[12] The progressive falling-off of production in both curves is attributed to fatigue and is characteristic of production trends on work which is not largely influenced by monotony effects.

The morning curve shows a rise during the first hour, which

[12] J. Goldmark, and M. D. Hopkins, "Comparison of an Eight-Hour Plant and a Ten-Hour Plant," *U.S. Pub Health Serv., Pub Health Bull.*, 1920, no 106, 74.

is known as the *warming-up period.* The exact cause of the warming-up period is not known, and is undoubtedly because of the fact that the phenomenon depends on a variety of factors. True warming-up is usually understood to entail certain physiological adjustments. Muscles must be limbered up and a number of circulatory adjustments, such as changes in blood pressure and the circulation, have to be made in accordance with the work pace. Other factors, ranging from making the necessary tool arrangements to getting into a working attitude, also enter into the picture. The exact duration of this warming-up period is also unknown, but it most probably varies from job to job and from individual to individual. It is safe to assume that the period is definitely less than an hour and that in many instances it is a matter of minutes. The psychological aspects associated with getting started undoubtedly are more delayed in actual practice than are the physiological adjustments. A businesslike work atmosphere and a healthy state of mind contribute greatly to making the necessary psychological adjustments.

Between the second and third hours the combined production of a large group of men usually reaches its peak. Thereafter, production gradually falls off. It is this continuing decrease which reflects the presence of industrial fatigue.

The afternoon curve frequently shows no evidence of a warming-up period; if present at all, it is of shorter duration. Afternoon production ordinarily begins at a higher point than that which obtained at the end of the morning curve, showing the characteristic recovery which one would expect because of rest and lunch. Thereafter, the curve falls more rapidly than was the case in the morning, which indicates incomplete recovery during the work pause. The final hour usually shows the lowest production of the day.

Part of the low production at the end of a day may be due to a tendency to quit early or to begin putting away tools. Like some phases of the warming-up period, such activity cannot be rightly

attributed to a fall in production brought about by fatigue. The general downward hourly trend, however, reflects the condition of lowered production because of previous work and justifies the characterization of *industrial fatigue.*

Another feature of some production curves which should be mentioned is known as the *end spurt.* It consists of a rise in production at the end of a work period and appears in some instances only. It is possible that it always occurs, but in some cases it is not apparent because its presence is covered up by the fatigue effects which have the opposite influence. Evidence for the end spurt is most commonly found in work which does not require physical exertion. This temporary rise in production may be attributed to the motivation of approaching a goal, which in most cases is the end of the day. Production measured in fifteen-minute periods would probably show the presence of end spurts in many instances, whereas hourly measures are too crude to separate their effects from fatigue effects. In the next chapter this influence of approaching a goal will be considered in detail.

The production curve thus reveals three characteristic features: the warming-up period, the end spurt, and the fatigue effects. Each of these phenomena is undoubtedly attributable to a complex of factors, but all have basic causes which can be determined and which are worthy of investigation.

HOURLY PRODUCTION IN LIGHT AND RAPID WORK

It is sometimes claimed that fatigue is a negligible factor in modern industry because most of the work is fairly light and because the hours are relatively short. It is desirable, therefore, to study production in an industry in which the work is light and the hours reasonably short. Hourly production in typesetting seems to satisfy these specifications. A comparison of typesetting in two Italian firms (A and B) and a British firm (C) is shown in Table 7.[13] This comparison is of particular interest because the

[13] From data cited by Muscio, *op. cit*, pp. 69–71.

TABLE 7. HOURLY PRODUCTION IN THREE PRINTING HOUSES
(From Muscio)

Hour of Day	*Percentage Production Firm A*	*Percentage Production Firm B*	*Percentage Errors Firm B*	*Percentage Production Firm C*
8– 9	13.6	13.8	12.9	12.9
9–10	17.1	17.0	7.6	13.1
10–11	14.6	15.1	13.9	12.8
11–12	14.0	14.1	21.3	11.9
12– 1	Lunch and Rest			Lunch and Rest
1– 2				11.9
2– 3	15.9	16.2	4.2	12.8
				Tea ten minutes
3– 4	14.0	13.4	17.2	13.2
4– 5	10.8	10.5	22.8	11.3

work pattern in the two countries is different in certain respects. The Italian work-day is seven hours long and is interrupted by a two-hour lunch and rest period. It will be noted that in both firms the high point in production occurs during the second morning hour and that the next highest point occurs during the first afternoon hour. Although the afternoon production begins at a fairly high point, it drops rapidly and reaches its low point at the end of the day.

In the British printing house (firm C), the work-day is eight hours long, with one hour for lunch and a ten-minute period for tea in the afternoon. From the table it will be seen that the morning production trend is similar to that of the Italian, except that there is less variation in the hourly production. The afternoon period shows marked differences, however, and it is during this period that the work pattern deviates from that of the Italian

firms. Although the low point in production occurs during the last afternoon hour, the other three hours do not show the typical trend. The first hour after lunch shows no evidence of recovery, and the second and third hours show no fatigue trend. One can explain the greater uniformity in production by supposing that the work is paced more uniformly, but this does not explain the lack of fatigue effects in the second and third afternoon hours. During these hours the average production is as high as during the best two hours of the morning. The afternoon tea seems to hold the key to their analysis. After the tea it is reasonable to suppose that the typesetters are refreshed; before the tea they may be motivated by anticipating the tea period. The suggestion that a social and stimulating tea period may influence production both before and after the period is certainly worthy of consideration, particularly when this effect is obtained in a four-hour afternoon period as compared with the Italian three-hour period. The type of noon meal served in England and Italy may also account for part of the difference in production during the first afternoon hour.

Figures on errors for one Italian firm are also given in Table 7. These figures show that the number of errors increases whenever the production decreases, but the changes are more marked in the case of errors than in the case of production. Since printing-errors require considerable time for correction, actual or finished production is greatly lowered by frequent errors. If allowance is made for errors, it is evident that the actual production changes much more with fatigue than the tabulated production figures indicate.

Because errors and accidents probably have similar causes, the error data probably reflect a striking relationship between fatigue and potential accidents. The same condition which results in an error in typesetting may cause an injury in another kind of work.

The data on production in typesetting clearly show that industrial fatigue is a factor in light, rapid work and is not confined to the heavy industries. That the nature of the fatigue may be

quite different in work requiring varying degrees of muscular exertion is quite beside the point. The fact that continued work of almost any kind is associated with a fall in production is sufficient reason for accepting fatigue as a universal industrial problem. Analysis of the nature of fatigue, however, is important when the question of fatigue elimination is raised. The various aspects of fatigue in general are naturally influenced by different conditions. For this reason it is important to discover the varieties of industrial fatigue.

THE EFFECT OF REST PAUSES ON PRODUCTION

The introduction of rest pauses in work does not make possible a comparison between work with and without such pauses, because spontaneous rest pauses inevitably occur, whether or not they are recognized. The question which is of interest to industry is whether or not externally introduced rest periods increase production.

The evidence clearly shows that increases from 10 to 20 per cent are very common.[14] For instance, the introduction of a ten-minute rest pause in the morning work period for girls engaged in labeling resulted in a 20-per-cent increase in production.[15] In another study, rest pauses of seven minutes, introduced in both morning and afternoon work periods, favorably changed the entire shape of the hourly production curves.[16] Other studies have used frequent and short rest periods. Favorable results have been found with a five-minute rest after each hour of work and even when a two-minute rest is alternated with three minutes of work.

The best distribution of rest pauses has not been determined

[14] For a detailed discussion see M S Viteles, *Industrial Psychology*, pp. 470–482, and H. M. Vernon, *Industrial Fatigue and Efficiency*

[15] H. M. Vernon, and T. Bedford, "The Influence of Rest Pauses on Light Industrial Work," *Indus Fat. Res. Bd*, 1924, Rep no 25, 20

[16] E. Farmer, and S M. Bevington, "An Experiment in the Introduction of Rest-Pauses," *J. Nat. Instit. Indus. Psychol.*, 1922, *1*, 89–92.

at the present time, but it may be expected to vary considerably with the type of work. It is quite generally agreed that the rest pause should be introduced just before production begins to fall off. This opinion is based on the results of a number of investigations and corresponds to what one would expect from the ergograph results. Because rest periods may serve as interruptions and create unfavorable results, it may be desirable to permit the individual a certain degree of freedom in their arrangement. When a person is engaged in finishing a unit of work, an externally imposed pause may serve as an irritant because it disrupts the work pattern. For reasons of this sort, the work patterns should be carefully studied and the rest pauses adjusted accordingly. Training individuals to distribute their rest properly may be the best solution to the problem of distributing rest periods in accordance with variations in jobs and differences in people. A method of doing this will be discussed later in this chapter.

One of the difficulties encountered in studying the specific effects of rest periods on production is the fact that an improved attitude toward the company is frequently associated with their introduction. As we pointed out in Chapter 3, the effect of the better attitude tends to confuse the data, making it difficult to determine how much effect is attributable to rest pauses and how much to the attitude factor. Although the total effect makes the use of rest pauses very desirable to the industrialist, the scientist is interested in separating and measuring the various sources of influence. It may be pointed out, however, that one of the most favorable conditions introduced in the Hawthorne plant was that which included fifteen minutes for lunch and rest in the morning and ten minutes for rest in the afternoon.

THE EFFECT OF LENGTH OF WORK–DAY ON PRODUCTION

During the depression of the nineteen-thirties an attempt was made to distribute work among a large number of people by shortening the work-day, while, during the war effort, an attempt

to increase production by increasing the length of the work-day was made. These procedures presuppose that production is a function of the number of hours worked. Considering the effect of fatigue on production, one may rightly question the validity of this supposition.

EXCESSIVELY LONG HOURS

The story is told of a woman worker in a surgical-dressing factory who refused to follow the work-day maintained by the plant.[17] The hours were from 6 to 8 A.M., 8.30 A.M. to 12.30 P.M., 1.30 to 5.30, and 6 to 8 P.M. Meals were eaten in the half-hour free periods. The woman in question not only refused to work before breakfast, but also declined to return in the evening. When questioned, she claimed she stayed away because she could do more work if she worked only the eight hours. Investigation revealed that, in a month's time, this woman's output was 52,429 bobbins. While she worked 160 hours, the co-operative workers put in 237 hours, yet not one of them produced as many bobbins. The average production of the three best workers was 48,529, while the production of the best worker was 51,641. Since it is unlikely that any one person can be that superior to the best workers in a group (see curves of individual difference in Chapter 6), it would appear that the shorter work-day was the only plausible explanation for her superior productiveness.

Another illustration concerns two groups of apple-packers. Under pressure to get the work done, one grower permitted his men to work ten hours per day, while another limited the work of his men to eight hours. The packing was on a piece-work basis in both instances. The results showed that the packers who worked eight hours averaged five cases per day more than those who worked ten hours.

Comparisons of the production of men in countries which have different work-weeks and comparisons of production before and

[17] Muscio, *op. cit.*, p. 73.

after reductions in the work-week in the same country invariably show that shorter work-weeks are associated with greater production. Labor's agitation for shortening the work-week has thus led to increases in production, while management's opposition to these changes has had the effect of retarding the efficient utilization of man's energy.

It may be claimed that these results obtain only when the work-week is very long; that at the present time the hours may actually be too short for full efficiency because labor has pressed these reductions in hours too far. Since the answer to such assertions is a matter of fact and not one of opinion, we shall turn to an examination of the available evidence.

Under the pressure of the war emergency, England increased its work-week.[18] Before Dunkirk, the work-week was 56 hours, while after Dunkirk it was increased to an average of 69.5 hours in the war industries. The first effect of this increase was a 10-per-cent rise in production, but then production declined, and sickness, absenteeism, and accidents increased. By the end of a couple of months, the average work-week was 68.5 hours, but the average amount of time worked was only 51 hours, as compared with the period before Dunkirk when the average time worked per week was 53 hours. As a result, production was 12 per cent below that preceding Dunkirk. Six months later, the shorter week was restored, with the result that production steadily rose to a higher point than ever before.

The British Medical Research Council concluded that a major cause of the fall in production was the long work-week. Although bombing was responsible for some of the reduced production, it could not account for the major changes. On the basis of this experience, the Research Council recommended a maximum work-week of 60 hours or less for men and 55 hours or less for women. In this country, where the work-pace is more rapid than in England, these figures are probably too high.

[18] *The Nation*, April 11, 1942, p. 412.

The experience of England throws grave doubts on the advisability of increasing production by means of overtime work. Working extra hours obviously results in some production, but its effects on subsequent production are likely to be considerable. Under stress of great motivation, these trends may be temporarily altered, but, eventually, undesirable effects may be expected.

OPTIMUM WORK-WEEKS

Let us now consider the effects of reducing hours below those of the eight-hour day. During the N.R.A., the Waverly Press went on a six-hour day.[19] The employees had the choice of working two three-hour periods or one six-hour period each day. They chose to work the six hours in one stretch. The first effect of the change from eight to six hours was a 5-per-cent drop in production (from 100 to 95) and a doubling of errors. As the employees became accustomed to the new work pattern, however, the hourly production rose to 115, or 15 per cent above the normal level, and the errors were somewhat less than before the introduction of the six-hour day. With an hourly production of 115, the six-hour day yielded 690 production units, whereas the previous eight-hour day had yielded 800 units on the basis of eight hours of production at 100. Considering that errors were also reduced, this means that production for a six-hour day is approximately the same as for an eight-hour day. A more efficient use of the six-hour day, such as interrupting it with a lunch period, might have made up for any slight difference that remained.

In a more detailed study, work-weeks of 36, 40, 44, and 48 hours were compared.[20] The hourly output for the 40-hour week was found to be the most efficient, the production being 868 units. With the 44-hour week, the hourly production fell to 839 units; and with the 48-hour week, it dropped to 793.5. For the 36-hour

[19] *Kalends*, *3*, 5–8

[20] G. H. Miles, and A. Angles, "The Influence of Short Time on Speed of Production," *J. Nat. Instit. Indus. Psychol.*, 1925, *2*, 300–302.

week, the production was 834 units, which made this work pattern less efficient (per hour) than the 40- and 44-hour weeks, but more efficient than the 48-hour week. The inefficiency of the shortest work-week may be due to loss in practice and proper work attitudes or to any number of other factors.

The differences in hourly production between 40- and 48-hour weeks are not sufficiently great to make the total weekly production of the 40-hour week greater than that of the 48-hour week. Apparently, the 48-to-54-hour week is approximately the work pattern which yields the greatest weekly output. Only when the work period exceeds these hours is the decrease in hourly output sufficiently great to make the longer week less productive than the shorter week.

The evidence presented above shows that the work of one day may seriously hamper that of the next. This point is further supported by the finding that production falls off during the week, the high point falling on Tuesday, followed by a rather gradual reduction until the low point on Saturday is reached.[21] The fact that Monday's production was below that of Tuesday suggests a phenomenon analogous to warming-up. That the weekly trend should show similarities to the hourly trend in production is interesting and worthy of investigation. Whether this persisting fatigue phenomenon is due to incomplete recovery from one day to the next or to a need for recreation, without which man is deprived of a necessary stimulant to life, is not known. Certainly, recreational facilities introduced into plants which have long hours would seem a safe investment.

In deciding upon a most efficient work-week, it is desirable to distinguish between its effect on hourly production and its effect on weekly production. From the standpoint of efficiency, measured in terms of production per hour, a work-week around forty hours seems to be the optimum under existing conditions. If,

[21] W. N. Polakov, "Making Work Fascinating as the First Step Toward Reduction of Waste," *Mech. Engin.*, 1921, *43*, 731–734; 765.

however, there is a shortage of labor and the purpose is to get the maximum amount of goods produced with the manpower available, then a work-week in the vicinity of fifty hours is the optimum.

The optimum conditions will, of course, vary for men and women, for different working conditions, and for degree of accessibility of the factory to the home. The proper utilization of rest periods, pleasant working companions, and the stress of the times would tend to increase both optimum figures. That optimum figures exist and that arbitrarily increasing the work-week does not necessarily increase production must be recognized. To criticize workers who work long hours for their slow rate of production and excessive absenteeism neither solves the problem nor improves morale. The most charitable thing that can be said about this form of criticism is that it may be attributable to ignorance.

More research is necessary before the best conditions can be fully determined. That there is still much to be gained by properly adjusting the work pattern can hardly be doubted. Research along these lines should always involve a period of several months because an individual must have time to adjust to the changed work conditions. Beneficial changes may not appear for a month, and, when they do occur, they should be maintained for a period of time if they are to be considered actual changes.

THE WORK SHIFT

The question of whether the optimum work period varies with the shift cannot be answered in the light of the present data. There is general agreement, however, that the night shift is lowest in production. This raises the question as to why this should be so. It seems probable that one of the factors involved is the changing from one shift to another. Since men do not like this shift, it is customary to have them change shifts so that each has the opportunity to work on the favored shift. This custom con-

stantly interrupts the living and work program of all employees. Men have to learn to sleep in the daytime and to work at night. The physiological rhythms depend also upon one's pattern of activity. For these reasons it seems undesirable to change men from one shift to another. Retaining men on the same shift would, of course, entail the necessity of making the night shift more attractive by using extra financial incentives. If, however, this procedure increased the production of the night shift, it would easily offset the extra cost.

If modern industry continues to operate on a three-shift basis, it is necessary that the manner of living change accordingly. Stores, restaurants, and amusement houses must follow a similar pattern, and people on the same shifts must become companions in order to permit a social life which fits into their work schedules. During the transition period, industry can do much to make shopping and recreational facilities available to its employees.

MOTIVATING MEN TO SPACE THEIR WORK

When left to their own devices, men do not generally develop the most efficient work methods and it is improbable that they will distribute their efforts in the most efficient manner. We have seen that rest periods planned by the company are superior to unauthorized rest periods, but these are sometimes difficult to adjust to the job. In cases in which men are paid on a piece-rate basis, they may even resent "forced" rest periods, although it is under the stress of high motivation that rest periods are most essential. It is, therefore, desirable for the company to try out different methods of distributing work. Men can be told the value of short rests and the importance of taking them before they feel any marked symptoms of fatigue. If, however, men are to restrain themselves from undue effort, particularly when working on a piece rate, it is desirable to give them an incentive for doing so.

Suppose the morning and afternoon work spells are broken into four periods each, making a total of eight periods. If, now,

production is figured in terms of eight times the production of the lowest production period, rather than on the basis of the sum of the production of the eight periods, a man could obtain the greatest daily production by producing the same number of units during each period. For example, a man producing 18, 20, 17, and 14 units in the four morning periods and 16, 15, 12, and 10 units in the four afternoon periods would actually produce 120 units, but he would be paid for only 80 (8×10) units. By producing 15 units each hour, however, the man would receive payment for the full amount of his production. This would encourage him to space his work. Soon he would discover that he had enough time to produce 16 units rather than 15 units per period. If he found this easy, he could try increasing hourly production by another unit. By this procedure, he would soon discover the pace which was most efficient for him.

This method has a number of advantages. In the first place, the man would find ample time for rest pauses in the first three morning work periods, and these would come early enough in the work program to prevent the setting-in of fatigue. In the second place, he could space the rests to satisfy his own interests and not feel that he was being hurried or running behind schedule. Finally, he would have a goal at which to aim, and, as we shall see in the next chapter, this fact makes work less monotonous. It is well known that any program of work is easier and more interesting if quotas or goals are involved. At the same time, the plan permits variation to suit the ability of the individual. Any feeling of unfairness toward the method of pay would disappear, once the plan was put into practice.

15 PSYCHOLOGICAL FATIGUE AND RELATED PHENOMENA

THE VARIETIES OF PSYCHOLOGICAL FATIGUE

THE TERM *psychological fatigue* is here used to designate the more elusive types of factors which cause work decrement. It includes the falling-off in efficiency of work which is commonly referred to as *mental fatigue,* as well as the phenomena known as *monotony* and *boredom.* The influence of attitudes and motivation on work decrement, also, should be considered under this category.

In so far as true mental fatigue exists, the phenomenon may be one of brain, or nervous, fatigue. Monotony and boredom, we shall see later, are influenced by the way a person views his task from time to time, causing the output to fluctuate rather than to fall off progressively. The manner in which a job is perceived or experienced is an individual matter, but certain kinds of tasks and work atmospheres are more likely to induce monotony and boredom than are others. These experiences are rather special forms of fatigue which are probably more psychological than physiological in nature. The influence of morale on work decrement is also primarily psychological and is perhaps closely associated with motivation.

Motivation is found to be a factor in all forms of fatigue in the sense that the rate of fatigue for almost any type of task varies with the intensity of the motivation. When motivation is low, fatigue effects become apparent very early, but, when motivation is high, the evidence of fatigue may not be apparent until con-

siderable physical exhaustion is manifest. Even though its symptoms are often vague and indefinite, the importance of psychological fatigue must not be overlooked. It is an important aspect of industrial unrest as well as of work decrement; it may be even responsible for the increase in nervous disorders in modern life. Mental conflicts and frustrations are so commonly associated with man's work that it is to the industrialist's interest to determine methods for reducing their incidence.

THE EFFECT OF MOTIVATION ON ENERGY EXPENDITURE

THE THEORY OF THE DISTRIBUTION OF ENERGY ACCORDING TO THE TASK

It has already been suggested that motivation influences a man's *will* to work. This does not mean that a man is free to *will* more or less energy expenditure and that the proper willingness is up to him. (See Chapter 12.) Rather, the amount of energy he may have to spend for a task seems to depend upon the motivating conditions he finds in the work situation. It appears that the influence of motivation on work is one of determining the amount of energy which will become available for a task. Work energy is not stored in man in such a way that it can be drained off. Rather, it is more appropriate to think of this energy as inaccessible until a condition of motivation exists; even then only a given amount becomes available for a specific kind of activity. As a result, the energy for a given task may become depleted without greatly reducing the total supply. It is as if the energy were rationed and that a particular job must have certain priorities if it is to get a good share of the energy. After a day at the office, a man may be too tired to work overtime or to help his wife put the children to bed, but if a fishing trip is suggested, plenty of energy becomes available. The man's basic supply of energy is not depleted by his work, but the portion allotted to a given task is exhausted. If many allotments are made, the total supply becomes reduced. Rationing then becomes

more strict; higher priorities are needed and smaller allocations are made. Thus, the actual supply of energy is limited, but it is seldom, if ever, depleted because the rationing protects the basic supply. The depletion which is commonly experienced is the exhaustion of an energy assignment. Motivation controls the distribution of energy; thus it is the key process in the rationing procedure.

According to this view, it may be said that high motivation makes more energy available, while low motivation releases a lesser amount of energy for the task at hand. It follows, then, that the problem of reducing fatigue can be approached either by making more energy available or by efficiently utilizing the quota of energy that has been made available. Motivation reduces fatigue by increasing the energy supply, whereas such factors as rest periods and speed of work reduce fatigue by causing the energy to be spent efficiently, regardless of the amount allotted. Since these two types of influence on fatigue are altogether different, we can understand why the curve of fatigue does not always follow the same trend. Men sometimes perform heroic deeds and show surprising degrees of endurance without succumbing to fatigue. These exceptional feats appear superhuman only because we try to interpret them in the light of the more common and limited allotments of energy, while, actually, unusual amounts of energy have been made available in such instances. The theory that fatigue is influenced in two distinctly different ways gives a basis for the explanation of many of these unusual cases of human endurance and strength.

EXPERIMENTAL FINDINGS WHICH SUPPORT THE THEORY OF ENERGY DISTRIBUTION

Experimental evidence in support of the theory that energy is distributed according to the task comes from an ingenious experiment performed on animals. Evidence from animal behavior in a problem of this kind is particularly convincing, since it shows that

the phenomenon is a fundamental process; at the same time the data are not distorted or confused by higher mental processes, which may alter the outlook on the task and indirectly influence the results. In the experiment in question, rats were trained to run a certain distance along a path before they made a turn that led to food.[1] Since identical paths led off the main route at one-foot intervals, the only way for them to locate the correct turn was by learning to run a certain distance; that is, to recognize when they had spent a certain amount of energy. With motivation held constant, the problem was learned with considerable accuracy. Changes in motivation were then introduced. When motivation was increased by lengthening the period of food deprivation, the animals invariably made the turn farther along the path; when the motivation was decreased below normal, by shortening the period without food, the animals made the turn too soon. In other words, when the animals were highly motivated, they underestimated the energy they had expended; when they were poorly motivated, they overestimated it. If these errors in estimating energy expenditure can be produced by motivation, one must suppose that motivation influences the energy supply, and in this manner distorts the judgment of how much was spent. It is likely that spending half of a large amount of energy feels very much the same as spending half of a small allotment of energy.

In another experiment an ergograph was used to measure the ability of human subjects to do physical work under different conditions of motivation.[2] Under one condition the subject was required to apply maximum force for as many trials as possible, while under another condition he was required to apply as much force as possible; in addition, he was told to keep his strokes above a line which was drawn on the record sheet. The second condi-

[1] R S. Crutchfield, "Psychological Distance as a Function of Psychological Need," *J Comp Psychol.*, 1939, *28*, 447–469.

[2] W. R. Wright, "Some Effects of Incentives on Work and Fatigue," *Psychol. Rev.*, 1906, *13*, 23–34.

tion thus specified the amount of energy expenditure which the subject must try to exert. Under the second condition less fatigue was apparent and more energy was available. The difference in energy expenditure for various persons working under the two conditions ranged from 14 per cent to 68 per cent, with an average of 37 per cent. This experiment supports the view that the condition of motivation influences the amount of energy which will be available for work.

Interesting also is the fact that, when the minimum requirement of work was too high, it ceased to be effective; that is, the energy supply did not meet the demand. An obviously unreasonable demand fails to increase the available energy because, in such cases, the level of aspiration (see Chapter 12) is not influenced by the instructions.

This interpretation of motivation as a factor in determining the energy supply is consistent with the facts of a number of other experiments which show a relationship between motivation and learning behavior, as well as with common experiences concerning the relation between motivation and industrial work. So-called "lazy" people seem to have a deficiency in energy, yet we may be surprised at their endurance when sports are involved. Since their energy is available only for certain activities, it is a problem in motivation to make energy accessible for useful pursuits. The effect of group decisions, discussed in Chapter 13, illustrated one way in which extra work energy was tapped by motivation and should be reconsidered at this point. Evidence which shows the importance of motivation in relation to the ability to resist mental fatigue will be considered when the problem of satiation is discussed. The treatment of the effects of the non-completion of tasks, found at the end of this chapter, shows how specific jobs build up available energy which becomes troublesome if it is not resolved by completing the job.

WORK DECREMENT IN MENTAL OPERATIONS

Assuming that motivation can be kept fairly constant during a laboratory experiment, there is evidence to show that both speed and accuracy are reduced as the work period continues.[3] Tasks such as the mental multiplication of two- or three-place numbers, reciting the alphabet backwards repeatedly, and the memorizing of words or syllables produce evidences of fatigue within an hour. Likewise, signs of warming-up and end spurts also appear. In the case of such mental operations, practice effects occur which minimize the extent of fatigue and exaggerate the warming-up effects, but controlled experiments clearly show that the warming-up and work-decrement phenomena are as common in mental operations as they are in physical work.

As in the case of physical work, rest periods delay the onset of the work decrement. In general, frequent short rests seem to be more effective than a few longer ones. Too long a rest period seems to be a disturbance in many forms of mental work because the person loses the continuity of the work or gets out of the mood for it. In general, pauses about five minutes in length seem to be beneficial. The actual percentage of rest required for mental work is probably less than that for physical labor. Under optional conditions, heavy physical work requires that at least 16.6 per cent of the time be spent in resting if the greatest efficiency is to be attained.[4] In arriving at this figure, physically superior college students lifted weights over their heads for an eight-hour day, one day a week. They rested nineteen hours before work began and relaxed on cots during the rest periods. In actual industrial practice, this figure would undoubtedly be too low for hard physical work, but it would be more than ample for common forms of mental work.

[3] A good summary of this work can be found in A. G. Bills, *General Experimental Psychology*, chaps. 22 and 23.

[4] G H Shepherd, "Effect of Rest Periods on Production," *Person Jr*, 1928, 7, 186–202.

In order to put the theory of mental fatigue to a crucial test, one experimenter set herself the task of the mental multiplication of four-place numbers.[5] After practicing to develop skill, she worked on such problems continuously for twelve hours on four successive days. The average time per problem was 9.5 minutes on the first day and 7.5 minutes on the last, indicating that there was no detrimental carry-over from one day to the next. The improvement which did occur may be attributed to practice. Comparing time per problem at the beginning with that at the end of the day, we find that it rose from five to approximately eleven minutes. The striking feature of this experiment is that the reduction in efficiency is so small. One cannot assume that similar cases of endurance will occur in industry, because a high degree of motivation is not attained when a person must perform his duties day after day in order to earn a living. As a matter of fact, other experimenters have failed to duplicate this small amount of decrement in mental work. The accomplishment cited above should perhaps be regarded as an unusual feat, achieved under high motivation, rather than as a typical case of mental endurance.

Another investigator who wished to test the ability of the brain to continue activity began work on mental multiplication problems at 11 P.M. By 3 A.M., he was so fatigued that he required the assistance of his wife in getting into bed.[6] His problem-solving time increased five times during the four hours he was able to work. However, it should be pointed out that this investigator began the experiment on himself after a hard day's work in his office, so that the two test situations are not altogether comparable. The latter experiment also demonstrated that mental fatigue may reach a stage at which mental work and concentration are entirely impossible. When this point was reached

[5] T. Arai, "Mental Fatigue," *Columbia Univ. Contrib. Educ*, 1912, no. 54, 115.

[6] W. S. Painter, "Efficiency in Mental Multiplication under Extreme Fatigue," *J. Educ. Psychol.*, 1916, *7*, 25–30.

in the experiment, no amount of effort was sufficient to revive the thought processes.

Although the reader may be ready to concede from his own experiences that mental fatigue exists, this type of evidence was at one time discounted because all fatigue was thought to be purely muscular in nature. Fatigue caused by mental work was explained by assuming that there were sufficient muscular accompaniments (writing, eye movements, and attention postures) to account for the fatigue. We have seen that mental fatigue takes place when the body is relatively inactive and when neither eyes nor hands are used. Another reason for performing experiments of the type we have cited is to demonstrate that attitude and lack of motivation alone cannot account for the decrement in mental work.

MENTAL BLOCKING

Work which requires constant alertness and attention is subject to interferences known as *blocking*.[7] Most people have observed that, when adding a column of numbers, they reach momentary stages at which they repeat a sum over and over several times before they reach the next sum. Then, for a while, they find they can skip along from one number to the next in smooth succession until another block occurs. The same effect may be observed if one attempts to repeat over and over a word such as *banana*. The blocks are only a few seconds in duration, and several may occur per minute.

The phenomenon of mental blocking becomes objectively apparent when we measure the continuous results of mental work. If a person is asked to name a series of colors, give the opposites of a list of words, or add a series of sums, and if his responses are recorded on a revolving drum so that each response makes a mark, it is found that these marks are irregularly grouped.

[7] A. G. Bills, "Blocking: A New Principle in Mental Fatigue," *Amer. J. Psychol.*, 1931, *43*, 230–245

A few responses occur rapidly, then there is a delay, followed by another set of responses. Such records show that the responses either are very close together or fairly far apart.

The blocks or lapses in performance are associated with the making of errors. Mistakes in arithmetic tend to occur at the points where the blocks occur. Long blocks not only produce errors, but materially delay the speed of work. In industrial situations in which constant vigilance on the work is necessary, these blocks may cause accidents.

There are wide differences among people in the length of their mental blocks, as well as in the frequency with which they occur. The number of blocks range from two to six per minute in different people. Individuals who tend to perform slowly in experimental tests are also likely to be the ones who have long or frequent blocks.

Blocking probably functions as an automatic method of resting; for this reason an activity requiring attention can go on with only brief interruptions. Continued work, however, produces an increase in the length and frequency of blocking incidents, and this phenomenon probably accounts for the decrement in mental work which gradually appears as the work period continues.

MONOTONY AND ITS RELATION TO EFFICIENCY

The experience of monotony is often regarded as the curse of modern efficiency. It is claimed that repetitive work makes robots of men and that it destroys such human values as pride in workmanship and individuality. The Charlie Chaplin film, *Modern Times*, was primarily a satire on this aspect of the present-day era. There is a general belief that boredom and dissatisfaction are common in our present methods of production. To what extent these conditions are read into the situation by people who actually do not have to do the work and to what extent a state of boredom really does influence production are questions worthy of consideration.

The industrial studies, in general, are in agreement in indicating that the mental state of monotony is associated with definite fluctuations in the rate of working and with a fall in production. In one of the most exhaustive studies this relationship was demonstrated by showing (1) that production was low and variable during periods when boredom was experienced and (2) that the production of individuals who felt very bored was lower and more variable than that of individuals who did not feel bored.[8] It was found also that the more-intelligent workers were more subject to work depressions than were less-intelligent workers, who, in turn, were more steady in their work pace and more satisfied with the work. Significant, however, is the fact that the production of the more-intelligent workers exceeded that of the less-intelligent ones, despite their dislike for the work and their variation in work rate.

Monotony effects are most pronounced during the middle of the work period and disappear in anticipation of the end of the period. In a state of boredom the workers are restless and feel under a strain; time seems to pass slowly. The extent of the monotony is dependent not only upon the repetitive nature of the task, but also upon the degree of attention which is required.[9] What the worker thinks about while doing repetitive work is a factor which influences the way the work affects him. Letting the mind wander seems to be one way of escaping boredom. If day-dreaming does not interfere with the ability to do good work, it is probably a useful adjustment, but if constant alertness is imperative, it may cause errors and accidents. Obviously, the best adjustment to repetitive work will vary with the nature of the job. We shall return to this question after analyzing the nature of boredom.

[8] S. Wyatt, J. A. Fraser, and F. G. L Stock, "The Effects of Monotony in Work," *Indus. Fat. Res. Bd.*, 1929, Rep. no. 56, 53.

[9] A good summary of industrial studies of monotony is given in M Viteles, *Industrial Psychology*, chaps 23 and 24. Other studies of interest are. S. Wyatt, "Boredom in Industry," *Person. J.*, 1929, *8*, 161–171; and H. Lossagk, "Experimenteller Beitrag zur Frage des Monotonie-Empfindens," *Indus. Psychotechn.*, 1930, *7*, 101–107.

That a good deal of the loss in production in repetitive work is due to the specific condition of boredom rather than to a true condition of fatigue is indicated by the facts (1) that afternoon monotony effects do not exceed those of the morning, as might be expected from accumulated fatigue; (2) that the anticipation of the end of the work period tends to abolish signs of monotony, and (3) that intelligent workers are more subject to monotony effects than are less-intelligent ones. These facts indicate that a knowledge of the nature of boredom is highly important, since such information might suggest methods for eliminating this mental condition. We shall assume that monotony and boredom are produced by similar conditions and that boredom is a more pronounced state of monotony. The presence of emotional tone in bored individuals is probably due to the more advanced stage of monotony.

AN ANALYSIS OF BOREDOM

THE PROGRESSIVE STAGES OF SATIATION

The nature of boredom or psychological satiation can be determined only by a carefully controlled series of laboratory experiments. One of the most enlightening and suggestive studies which have been made in this field was carried out under the direction of Doctor Kurt Lewin.[10] The college-student subjects were asked to draw vertical lines on a sheet of paper and to follow a certain pattern, such as alternately grouping the lines in twos and threes. As subjects filled one sheet of paper after another, the paper supply was replenished. They were never told to stop. With continued work on such simple repetitive tasks, variations in the work pattern began to appear. Such innovations as large and small lines, heavy and light strokes, tilted and curved marks were common. The method of making similar lines was also

[10] A. Karsten, "Psychische Sättigung," *Psychol. Forsch.*, 1928, *10*, 142–154. These experiments are also described in K. Lewin, *A Dynamic Theory of Personality*, pp. 254–257.

changed. Sometimes the lines were made with upward and sometimes with downward strokes. A great deal of variety was also achieved by changes in the work rhythm. Occasionally, whole pages were filled by a few long strokes; in such cases the paper supply was merely replenished more often. Ingenious persons drew their initials by making the parts of the letters with double and triple lines. Gradually the quality of work declined until it was sometimes difficult to make out what was being done. Only the aspect of grouping into twos and threes seemed to connect the later stages of work with the earlier ones. After about four hours the average subject reached a point when he could no longer continue. This was the stage of complete satiation.

Similar results were obtained when persons were asked to read the same poem over and over. Variations in interpretation appeared, and, as these ran out, different kinds of errors in reading and speech were made. Accent was changed, punctuation was ignored, and words were mispronounced. Words ceased to have meaning to the reader, and a listener would have had difficulty in understanding the poem. Finally, stuttering and choking on words occurred, until the stage of inability to talk was reached.

The stages (1) of variability, (2) of reduction in quality, (3) of difficulty in continuing to make the necessary movements, and (4) of complete inability to go on with the work characterized the course of satiation.

SATIATION AS A PSYCHOLOGICAL CONDITION

To demonstrate that the satiation could not be attributed to the fatiguing of the musculature involved, the experimenter merely changed the instructions. Subjects who could not write any more were told to finish the page or to write their names on the sheets, and their ability to write was restored as if by magic. Subjects who could no longer recite the poems were engaged in long conversations and showed no inability to use their

vocal mechanisms. Changing the task to be performed, without changing the muscles involved, completely restored the use of the muscles. Obviously, the defect in function was not muscular in nature.

SPECIFIC AND GENERAL ASPECTS OF SATIATION

Another aspect of the experiment showed that variability in work delayed the onset of complete satiation. Individuals who were ingenious in finding variations in the execution of the task were able to continue longer. When the experimenter introduced variations in the task, the stage of complete satiation was postponed. For example, having subjects switch to grouping lines in threes and fours or in twos and fives, or giving the reader a different poem to read, served to lengthen the period of activity. However, each change in instruction became less beneficial, so that eventually a whole type of activity (such as line-drawing or reading) was satiated. Variations prevented the satiation of a specific task, but they did so by spreading the satiation effects over a larger area. This condition of *area* satiation was also apparent when the activity of people who were ingenious in inventing variations was compared with that of those who conscientiously held to one way of executing the task. Individuals who varied the work of their own accord were not helped as much by the experimenter's variations as those who did not vary the work on their own initiative. It appears that all forms of variation tend to spread the satiation effects over a large area. As a consequence, those who vary at the outset satiate a larger area, and, although they escape satiating a more specific and limited region, they also benefit less when their work is changed for them.

THE IMPORTANCE OF THE EXPERIENCE OF PROGRESS

The experiment was next tried on a group of unemployed men who were paid a small sum per hour to serve as subjects. These men worked a full eight-hour day, and their work continued to be

as neat and accurate at the end of the day as it was at the outset. Unlike the college students, they found the work highly pleasant and hoped they could keep the job.

The difference in performance of workmen and college students was found to be due to the difference in the way the work appeared to them. For the unemployed men, the work period was fixed. As each hour passed, they moved along in the day and had earned more money. Analysis of the experiences of college students revealed that they tended to have the experience of marking time, or of just "getting nowhere." The paper supply did not diminish, they did not approach an end, and their activity achieved nothing; yet they had to continue because they had consented to serve in the experiment.

The absence of the experience of a *goal* or an *end* toward which one moves seems to be the cause of satiation, a cause which depends absolutely upon the way one views the task. In this experiment a particular view of the task was encouraged by the situation, but in actual work a great deal of variation may be expected. The same task may appear quite unlike to people with different backgrounds and different nervous systems. The same person may also view the same task differently on two occasions, or react differently to two tasks which another feels are very similar. What appear to be unimportant modifications in the arrangement of a task may actually change the whole outlook of a group of dissatisfied workers.

Finally, it should be pointed out that in the above experiment it was shown that the pleasantness or unpleasantness of the task had no effect on the rate of satiation. Whether or not a task was neutral to one's feelings was important, however. Neutral tasks were satiated relatively slowly, but tasks which were either pleasant or unpleasant were satiated relatively quickly.

SATIATION AND PHYSIOLOGICAL CONDITION

In another experiment it was found that during their menstrual

period women were much more susceptible to satiation than under normal conditions.[11] The women studied all had painless periods, so that discomfort was not the determining factor. This finding suggests that a day or two off each month would help many women to be more tolerant of their jobs. In addition to throwing light on one of the problems associated with the employment of women, this experiment shows that the physiological condition of a person is an important factor in satiation. The relation between satiation and the mental, as well as the physical, condition was also demonstrated in other aspects of the first experiment.

METHODS OF ELIMINATING BOREDOM IN INDUSTRY

The foregoing discussion demonstrates that satiation is a psychological phenomenon of considerable importance to the individual and that it is produced by definite natural causes. When the employer recognizes that boredom is not a fiction of the imagination and shows concern in coping with it, he has taken an important step forward. When he recognizes, further, that this mental state is frequently present in the most desirable employees, he will realize that the problem of boredom presents a serious challenge to management. As will be seen in Chapter 18, satiation is one of the important causes of labor turnover. It is also the source of conflict and emotional unrest, both of which are very important factors in the whole problem of fatigue.

The method of dealing with the problem will naturally vary for different types of work. In order to alter the way in which a job is experienced, it may be necessary to make changes in the work pattern. Although all jobs cannot be changed in the same manner, one or more of the suggested procedures should be applicable to most forms of repetitive work in industry. In general, it may be said that a favorable attitude toward the employer will produce a more tolerant view of the job, so this factor should be kept in mind at all times.

[11] A. Freund, "Psychische Sättigung im Menstruum und Intermenstruum," *Psychol. Forsch.*, 1930, *13*, 198–217.

EXCHANGING JOBS

If variability in a task delays the onset of satiation, it may be said that a change in work is as good as a rest, in so far as satiation is part of the general state of fatigue. In certain instances a change may be even better than a rest, because some changes in work offer more opportunities for variability than do rest periods. Nevertheless, rest and work are more unlike than any two forms of work. Rest periods which include a little amusement may have their value, despite the fact that diversional activity might create some physical fatigue. The value of active games during the lunch hour remains a problem to be studied carefully.

As pointed out above, satiation becomes quite general in the sense that an area or type of activity may be satiated. For this reason any changes in work which are instituted must give the person the *experience* of doing something different. What one person regards as different may be the same old grind to another. When high degrees of skill are not at a premium, it is probably expedient to permit employees to exchange jobs for days or even for parts of days. Variability on the same job should also be permitted. Different ways of doing the job, fluctuations in pace, and other variations which the worker may adopt serve the purpose if they are not extensive enough to interfere with skill and to increase muscular fatigue. When jobs require skill or heavy muscular exertion, however, the use of this method would amount to solving the satiation problem at the expense of disturbing the skill and work pattern.

RELATING THE JOB TO THE LARGER PICTURE

We have seen that the basis for boredom is the feeling of experiencing no progress. Whether or not progress is experienced depends upon the way the individual views the job. If a woman who is washing dishes experiences each dish as just another dish, washing a large stack of them will not be likely to give her an experience of progress. In contrast, let us take the case of a feeble-

minded boy of my acquaintance who loved to wash dishes. There being fifteen members in the family, he had ample opportunity to become satiated, yet he never even wanted help. When guests arrived on the farm, he refused assistance from sympathetic women on the grounds that they could not do the job correctly. For him each dish was an individual that he could recognize. This individualization was not too difficult, since several patterns and many cracked and chipped plates were in the family assortment. Each time he washed dishes, he had the pleasure of meeting a large group of old friends as he washed their soiled faces. He had his favorites and put them in the most desirable quarters of the cupboard. For him the experience of progress was rapid and the work interesting, since he moved from one friend to the next.

The typist who is interested in the people to whom her employer writes will find her work less boring than the girl who approaches letters as a stack of work. A little curiosity about other people's business may stand a secretary in good stead. Although individuals are different in the way they view a job, some of this interest for detail can be encouraged. Telling the typist a little more about the business and the customers or asking her opinion about certain matters would help a good deal.

In general, the term "red tape" refers to activity which is experienced both as boring and as unnecessary. If employees do not understand what the detailed record is about, they react to it as unnecessary. Teaching the employees the meaning of their work, how it fits into the total picture, how the records are arranged, and a number of other details would change much red tape into essential and important activity. Giving employees responsibility and opportunities for judgment is also very effective in accomplishing this end. Too often, the foreman tells a skilled workman exactly what to do on a repair job and treats him as if he had no understanding of his trade. The foreman feels that he must show his superior position and knowledge, but, instead of

demonstrating these things, he displays his inefficiency by wasting company time and making work boring for his subordinates. No superior should ever be allowed to say, "You do as you are told and never mind the questions." The amount of waste in production caused by workmen who knew they were turning out a defective part, but who had to do as they were told, would finance many improvements in working conditions.

THE USE OF SUB-GOALS

It is frequently desirable to go a bit farther and change the work pattern by introducing some landmarks. The end of the day ordinarily serves as a goal, the approach to which gives the experience of progress. Remote goals tend to be less effective or practically nonexistent; for this reason it is desirable to introduce sub-goals. Rest periods, particularly if they are attractive, may become very real sub-goals. The end spurt is very common in repetitive work; we have already pointed out in Chapter 14 how an afternoon tea was preceded by a period of heightened activity. Rest pauses can serve a dual function by decreasing boredom as well as all other forms of fatigue.

Sub-goals can also be introduced by grouping the production into larger units. A hundred units or a box of units may become a sub-goal. Making ten boxes of a hundred parts is not as repetitive as making a thousand parts. The reader will recognize how his enjoyment of a book is made more complete by having it divided into short chapters. Skipping along from one chapter to the next gives a feeling of progress that one would not attain by reading five hundred ungrouped pages.

We have already pointed out in Chapter 13 how group decisions increase motivation. Part of this effect is undoubtedly attributable to reduced boredom. When a specific amount of production is set, then a given number of units (as well as the end of the day) function as final goals. Specified amounts of production which must be attained at the time of a rest pause would also have this

effect on rest-period sub-goals. When production is made a part of the goals and sub-goals, it serves to increase the importance of these goals and makes progress toward them more meaningful and apparent.

The practice of breaking up tasks by introducing rest periods and by grouping the production units is an important method of reducing boredom. Since some form of this procedure can be applied to many types of work, it should be given serious consideration.

THE USE OF PACING METHODS AND AUTOMATIC WORK HABITS

Our analysis has shown that repetitive work creates boredom, not because the activity is repetitive, but because it creates the experience of marking time. If one can change the experience, but leave the activity the same, boredom will partly disappear. This point suggests that repetitive work should be made entirely automatic whenever possible. A job which is "second nature" to a man frees his mind for other things. One does not get bored with walking because one's thoughts can be on other things. However, if a person reacted to walking as picking up the feet and putting them down again, this activity would be most boring. Walking, however, leaves time for contemplation, day-dreaming, and conversation.

Since many jobs are as automatic as walking, in these cases conversation and day-dreaming should be encouraged. Industrial research has shown that the mid-work-period slump disappears when mind-wandering is prominent.[12]

However, taking the mind from one's work may interfere with keeping up a work pace. It takes attention to keep going at a good speed. Even so, this removal of attention may not be altogether undesirable, since the pace assumed without conscious effort may be a natural one for the individual. A natural pace is a desirable speed at which to work because it is often the least

[12] Wyatt, Fraser, and Stock, *op. cit.*

fatiguing. Even if day-dreaming tends to cause too much of a slowing-down in work, this condition can readily be corrected, because, since repetitive work is usually rhythmic, music or timing devices may be used to set the pace.

Industrial research has demonstrated that jobs which are repetitive in nature benefit greatly by external pacing methods. For example, the production on a job involving the sorting of metal plates rose nearly 18 per cent when a metronome was used to set the pace.[13] The reader may also be aware of the fact that marching is less fatiguing than walking without an externally imposed rhythm.

The effects of musical programs on simple assembly operations showed production increases up to 6 per cent, when production on days with music was compared to that on days without music.[14] Morning programs seemed most helpful, but the length of the programs (thirty to seventy-five minutes) was not important. In a radio-tube assembly factory in which music was customarily played, the effectiveness of fast, slow, and mixed programs was studied.[15] The scrappage rate was found to be less when either fast or slow music was played than when there was no music or when fast and slow musical programs were alternated. Musical programs also had a beneficial effect on employee morale.

Although music may be beneficial for a number of reasons, one of the most favorable effects is its influence on boredom. It takes the mind from the work and frees the brain of the obligation of initiating the activity as well. Also, progress may be experienced in the musical program, even if the job tends to give the experience of getting nowhere.

It may be thought that the removal of attention from the job

[13] H. Reinhardt, "Rhythmus und Arbeitsleistung," *Indus. Psychotechn.*, 1926, *3*, 225–237.

[14] S. Wyatt, and J N Langdon, "Fatigue and Boredom in Repetitive Work," *Indus Health Res. Bd*, 1937, Rep. no. 77, 86.

[15] J. F. Humes, "The Effect of Occupational Music on Scrappage in the Manufacturing of Radio Tubes," *J. Appl. Psychol.*, 1941, *25*, 573–587.

will increase accidents. This is a strong possibility on jobs where constant alertness is necessary. However, a change in the external conditions quickly recalls attention to the job, and in many occupations this allows ample time for making the required correction. The reader is probably aware that, while driving a car in the country, his mental content is often very remote from the driving activity at hand, yet an approaching car or obstacle on the road will bring his attention back to driving. However, one must not confuse mind-wandering with sleepiness. Inattention produced by fatigue cannot be changed to a state of attention as readily as inattention produced by mere repetition.

PSYCHOLOGICAL EFFECTS OF INCOMPLETED TASKS

INTRODUCTION

Modern production methods are characterized by the breaking-up of the manufacture of the industrial product into many parts. Each of the workers makes or assembles only a part, so that none of them have the experience of turning out a completed object. Is it essential to job satisfaction that the task be actually completed? The story is told of an industrial worker who, on his deathbed, was asked by his friends if he had a last request. "Yes," he replied. "Bring me a board with a screw driven halfway into it and let me drive the screw the rest of the way." All his life this man had worked on a production line and had driven screws part way into a board; now he wanted the satisfaction of finishing one off.

Interruptions are also common occurrences, and interruptions interfere with the completion of a task. A foreman, in pulling a man off a job, is interfering with job completion. In one instance, when a foreman wanted to take a man off the job he was doing, the workman refused to leave until he had finished it. The foreman stood on his authority and insisted that the man do as he was told. Words followed, and finally the workman struck the foreman. The foreman fell against a piece of machinery and was

killed. This death was the direct result of a fight which was started by a simple request which, if complied with, would have prevented the completion of a job.

It is a common occurrence for a man to put off starting a job near the end of the day. This behavior indicates a general tendency to avoid starting something that cannot be finished. Since this is the case, it is unjust to regard the business of "stalling" at the end of the day as evidence of disloyalty, disobedience, or dishonesty.

The illustrations which we have given demonstrate that the drive to finish a task once it is begun presents a psychological problem of no minor concern to management. Since the problem has been carefully investigated in the laboratory, it is of interest to recount the results in some detail.

EXPERIMENTS ON THE NONCOMPLETION OF TASKS

To obtain an index of the effect of preventing the completion of a task, one experimenter measured the influence of work interruption on memory.[16] Subjects were asked to perform a group of twenty tasks, such as modeling animals, stringing beads, and solving puzzles. Half of the tasks were allowed to go to completion, but the other half were interrupted and completion was prevented. At the end of the experiment, the subjects were asked to list all of the things they had done. It was found that the incompleted tasks were remembered about twice as frequently as the completed ones. Tests of memory, given some time later, showed the same difference. When a task was finished, it was easy to forget; whereas, when it was not finished, it lingered in the memory and even tormented the subject. When permitted to finish the incompleted tasks later, the subjects were greatly relieved and the memory difference disappeared.

Other aspects of the experiment made it clear that a certain

[16] B. Zeigarnik, "Ueber das Behalten von erledigten und unerledigten Handlungen," *Psychol. Forsch*, 1927, *9*, 1–85.

energy system is built up when a task is being performed and that it was the strain of the unspent energy which influenced the memory. A strong emotion tended to break up these strains, indicating that the energy system had its basis in emotional energy. Fatigue tends to reduce the energy available for a task, so, when the experiments were performed under conditions of fatigue, there was less difference between the effects of completing and not completing tasks.

In another experiment it was shown that there was a strong tendency to complete noncompleted tasks.[17] When the experimenter left the room on some pretext and then observed the subjects through a peep-hole, it was found that the subjects began searching the desk for the tasks that had been removed. The unfinished tasks were hurriedly completed and put back in place. When the experimenter returned, the subjects acted as if they had been seated all the while. It was not pride that made them want another chance at the unfinished job; rather, it was a need to dissipate the energy system connected with the task. On a number of occasions, when the experimenter met children who had previously served in the experiment, they begged for permission to complete tasks that had been interrupted.

The experimental evidence demonstrates that the performance of a task sets up a psychological condition which demands its completion. The strength of this demand varies with the task, the stage of interruption, and with the individual.

Tasks which have a definite point of completion are the most affected by interruption. For example, when modeling a clay dog, the task is not finished until the animal has acquired all of its parts. The interruption of such tasks invariably caused clear-cut reactions. In contrast, the activity of stringing beads was often experienced as completed despite the interruption. A partly finished long string of beads may be just a completed smaller string.

[17] M. Ovsiankina, "Die Wiederaufnahme unterbrochener Handlungen," *Psychol. Forsch.*, 1928, *11*, 302–379.

Some completed tasks were similar in their effects to other noncompleted tasks. Investigation revealed that such tasks, although completed, were experienced as incomplete. For example, a puzzle would be solved, but the subject might have missed the principle and feel that he was interrupted because he had not discovered how it worked.

The tendency to complete unfinished tasks which are either pleasant or unpleasant is greater than the tendency to complete emotionally neutral tasks, but the pleasantness or unpleasantness of the task does not influence the extent of the desire to complete it. The point at which a task is interrupted is a very important factor. Other things being equal, interruptions toward the end of the task create a stronger desire for completion than interruptions occurring toward the beginning. As the goal or the end of the task is approached, the motivation to complete it rises and the frustration created by interruption mounts.

Individuals who experience the task as a unit are more affected by noncompletion than are those who react to the tasks as something the experimenter wishes them to do. When a person becomes engrossed in what he is doing and is making good progress, an interruption is very painful. Persons who cannot comprehend the internal structure of a task and how its parts are related to the whole are relatively immune to noncompletion effects. Variations in the way a task is viewed explain some of the other individual differences. Whether one must separate two nails or learn how the puzzle works determines the completion point of such a problem. The method of viewing an assignment can sometimes be greatly altered by merely changing the instructions. However, all people do not respond to the instructions; some set up their own criterion of completion.

HOW TO AVOID INTERRUPTING THE WORKER

The tendency to complete a task is a source of motivation which should be constructively utilized. It is most characteristic of men

who become engrossed in their work. Constant frustration by interruptions forces such men to cease becoming engrossed in what they are doing. On the other hand, when they experience the satisfaction of completing tasks, they do not watch the clock, but are as insistent on finishing after hours a job once begun as they are on refusing to begin a job five minutes before quitting time.

Management should be vitally concerned with having its men experience their tasks as units or wholes. Getting out a hundred parts or reaching a quota should be experienced as the completion of a task. It is not necessary that men build complete automobiles or radios. They can experience their job as one of building complete sets or complete parts. Dividing the job into parts does not destroy the unity of work, provided other units are set up. These units may be a box of a hundred parts, the complete assembly of a unit of a radio, or the finishing of a set of orders. When paid for in terms of these arbitrary units, these activities can achieve the same status as building a complete radio. When a radio assembly is completed, its completion depends upon the fact that it is talked about and treated as a finished product. Another person may come along and consider it unfinished, because it has no case or because it has a case which is unpainted. Completion of a task is an experience, and this experience can be influenced by the way the job is set up.

Little changes in the layout of a job may also do much to eliminate the frustration of workers which is produced by the intrusion of others. Since a person may not be aware of the fact that these interruptions are the causes of friction, they continue undetected by management. In the painting department of one plant in Detroit, there was constant friction between inspectors and workmen. It was the practice of the inspectors to point out to the painters places they had missed and have them correct the oversights as they were discovered. After an analysis of the effect of non-completion of tasks, the job was rearranged. A man with a pail of paint was delegated to accompany the inspector on his

rounds and to fix up the places that had been missed by the regular painters. This procedure eliminated the inspector's constant interruption of those workers. The result of this minor change in the inspection methods was to establish harmony in the whole department and to increase production.

A little thought about methods for eliminating disturbing interruptions will suggest many other simple changes which can be made. In one instance an inspector carried a grudge against a superior for over ten years. It all started because the inspector, then a workman, was pulled off a job by his superior, who was then a foreman. Foremen should be trained to respect a man's absorption in his work. He can avoid being unreasonable about disturbing the work pattern and making men start jobs they cannot finish before quitting time. In many cases smaller units of work may be introduced to fill out a day, or the worker may be requested to carry the larger unit up to a certain stage. Since the end of an assignment is a goal, the use of instructions which specify an ending will give the worker some experience of completion.

It is a common experience in industry that friction arises between men working on different shifts. Part of this trouble is undoubtedly attributable to the fact that one man must finish a unit that was begun by another. This unit, which is the product of two men, is frequently below standard quality, and the man who finishes it often blames the poor workmanship on the man who started the work. Finishing a job that someone else started does not establish the energy system which is needed to create the proper preoccupation in the work. This practice of requiring men on one shift to take over where the men on the previous shift left off disturbs the work of the men on both shifts. It is questionable that it is ever necessary.

Failure to recognize the existence of this universal tendency to complete a task is very common. Parents neglect to recognize it in their children, or in each other, and executives may expect their men to leave a task at a moment's notice. Nearly every super-

visor can recall incidents in which he has violated the principle of the tendency in men to complete a task. Further consideration will undoubtedly reveal that the most enthusiastic and desirable workmen have been the most likely to show resentment when interrupted. To destroy this tendency in men is to change jobs from tasks which have the potentiality of giving experiences of progress and completion into purely repetitive and boring types of work. In no case is it a sign of good discipline when men are willing to leave a job instantly at the command of the boss. An efficient executive will let the employee fit the added duty into his schedule.

16 ACCIDENTS AND THEIR PREVENTION

INTRODUCTION

THE COST OF ACCIDENTS

The passage of workmen's compensation laws furnished a strong incentive for the development of safety methods in all occupations. Since this legislation introduced a direct charge for accidents, it made their undesirability apparent from the purely business point of view. However, the indirect costs of industrial accidents are several times as great as the direct costs (medical treatment and insurance). Indirect costs to industry include time lost because of the accident, breakage, hiring and training men to replace the injured, management's time in making reports and investigations, work stoppages by other employees, and welfare costs. In addition, the attitudes of workmen and of society become unfavorable when accidents are frequent. An unfavorable attitude invariably influences production and, eventually, sales, although these losses cannot be determined accurately. The realization of these indirect costs should serve as an even greater incentive for management to prevent accidents.

On the basis of analysis of accident data, Vernon estimated that the loss in potential production attributable to time lost through injuries sustained in industry in the United States amounted to $643,000,000 in 1932.[1] If, in the case of fatal accidents, the loss in future working time were considered, the cost would exceed a billion dollars. This loss may be considered a loss to society in

[1] H. M. Vernon, *Accidents and Their Prevention*, p. 23

general and represents inefficiency and waste in our present economy.

We in the United States have been somewhat slow in recognizing the fact that accidents can be prevented. We were from fifteen to twenty-five years behind European countries in adopting workmen's compensation laws. On the basis of fatal accidents (from all causes) occurring in 1925, we had an accident rate of 83 per 100,000 population, as compared to 38 per 100,000 in England and Wales.[2] To what extent this difference is dependent on the greater automobile traffic in the United States cannot be said, but it is known that traffic is the major source of fatal accidents in this country. The automobile is responsible for roughly one-third of all fatalities caused by accidents, whereas industry contributes about one-sixth, or half as many, of all fatalities.

Accidents causing permanent disability are about three and one-half times as common as fatal accidents, and of these, traffic accounts for about 50 per cent more than does industry. That causing temporary disability is the most common form of accident, occurring nearly one hundred times as often as the fatal accident. Industry contributes 35 per cent more of these accidents than does traffic, and is the source of about one-sixth of all such accidents.

ACCIDENT RECORDS

A program of accident prevention assumes that accidents are caused, and are not accidents in the sense that they are unavoidable events. Natural circumstances beyond man's control (lightning, for example) are a source of accidents, but, aside from these, man's behavior contributes to a lesser or greater degree to nearly all mishaps. His influence may be as indirect as a disinclination to demand periodic inspection of bridges, buildings, and machinery, or as direct as bumping into a revolving saw or absent-mindedly pushing another person into the saw. That there are definite

[2] Vernon, *op. cit*, p. 23.

causes for accidents is obvious from the fact that safety devices and safety methods have greatly reduced the accident rate.

In order to approach the question of accident prevention scientifically, it is necessary to determine the various types of causes. These naturally vary greatly for different types of work, although we shall see later that there are many causes which are common to all forms of accidents. In order to isolate the causes, it is essential that careful records be kept. From such records each industry can check its own accident data and make comparisons with data from other industries.

A good record involves more than a description of how the accident happened. That a man refused to use a safety device, oiled a machine while it was running, got his shirt caught in a gear, or lost his footing on a scaffold are important facts, but such descriptions do not tell what made the man do these things. The same man may have all these forms of accidents and all of them may be attributable to a single basic cause. Records must permit the isolation of factors lying behind the type of accident. To obtain the proper information, record sheets should be prepared which require the inclusion of pertinent data. These should permit the tabulating of various categories, so that, by means of sorting devices, the number of related accidents can readily be detected. The record cards should include data on the items discussed below.

1. *The number of employees at work* is a pertinent item in accident data, since all accidents should be reported in terms of the percentage of individuals having accidents. Statements, such as "men have more accidents than women" or "the total number of factory accidents increased during the war," have little meaning unless we know whether the *proportion* of accidents is different in the comparisons. Many of the accident data are almost valueless because the figures are limited to totals. When the exposure time to the work varies (as in automobile-driving), data on the number of employees

are incorporated in such expressions as "number of man-hours."

2. *The severity of an accident is important,* since it is misleading to group fatal accidents with scratches on fingers. Obviously, more effort should be made to prevent serious accidents than minor ones. In order to keep accident figures down, many companies do not list those of minor importance. We shall see later that data on these accidents are valuable, however. Jobs vary in the severity of the accidents which are associated with them. In one study, for instance, it was found that the frequency of accidents involving *lost time* (that is, inability to return to work for a time) and those involving only *first aid* varied greatly in eleven departments of a steel mill.[3] The correlation between the frequencies of these two classes of accidents was only .21. Comparisons showed that one department was highest in lost-time accidents and seventh in first-aid accidents, while another department was eighth in lost-time accidents and second in first-aid accidents. Such data show the necessity for distinguishing between these two degrees of accident severity, since major and minor accidents frequently have quite different causes. This does not mean that minor accidents are unrelated to major ones; rather, it means that some jobs offer relatively more opportunities for a given degree of accident severity than do others.

In presenting total figures, it is customary to give more weight to severe than to minor accidents. This is done by presenting the data in terms of time lost on the job. This method does not differentiate between permanent and temporary disability, since one may return to work after losing a finger in less time than after breaking a leg, yet the former represents a permanent defect and, in this sense, is more severe than the latter.

To permit various kinds of analyses, distinctions should be

[3] J. Tiffin, *Industrial Psychology,* Table 29

made between (1) the amounts of time lost, (2) permanent and temporary disability, and (3) fatal, lost-time, and first-aid accidents.

3. *The type of work* in which the accident occurs should be listed for the reason given above, as well as because it is desirable to know the degree of hazard in different occupations. One cannot accurately refer to a plant as having a high accident rate without comparing it with similar plants. For these reasons, an accident record should contain a list of occupations, and the accidents should be classified accordingly.

4. *The hour of the day and the shift* are important factors in accident frequency. Many conditions are altered from hour to hour and from shift to shift, and, if these changes are related to accidents, attempts can be made to correct those which are associated with increased accident frequency. Fatigue, for example, varies not only with the length of time worked, but also with the length of time the person has been awake and active. Night-shift workers go to work after a period of varied activity and sleep after work. Some even come to work in an intoxicated condition. Day-shift workers go to work after breakfast and obtain their recreation and sleep after work. Such differences in the pattern of living influence both production and accidents.

5. *Experience* is known to be another factor in the occurrence of accidents. How important it is in a given occupation, how it is related to the type of accident, and how training methods can reduce accidents which are caused by inexperience can be determined only by analyzing accidents in terms of experience.

6. *Age and the condition of health* are pertinent personal data. It is often desirable to analyze accident data according to age and physical energy. Complete records are necessary for this purpose. The importance of these factors may vary considerably with the occupation, particularly when speed, endurance, and extreme temperatures are involved.

7. *Psychological data* should be included whenever available. If tests are used in the factory, the scores on the various tests should be included in the accident record. The previous accident history should also be added. The importance of this data will be discussed later in the chapter.

8. *The immediate cause* should also be recorded when reports from witnesses can be obtained. Such facts as the following are important: (1) failure to use safety devices; (2) a defect in the operation of a machine; (3) whether or not the individual was hurt while actively working; and (4) the extent to which one individual contributed to the injury of another. Judgments as to whether the person involved was careless, ignorant, inexperienced, ill, sleeping, intoxicated, and the like, should be added for supplementary consideration, but they should not be regarded as complete explanations.

APPROACHES TO ACCIDENT PREVENTION

The prevention of accidents may be approached from the point of view of the engineer or from that of the psychologist. The method of the engineer is to remove the hazard from the work by changing the operation of dangerous machinery, designing and installing safety devices, and inspecting the safety of the building and the machinery with a view to structural or functional changes. Simple improvements include enclosing moving parts, such as belts and gears; using paints to make stationary and moving parts more readily distinguishable; attaching guards so that the body cannot come in contact with rotating saws; designing safety goggles; and building floors or platforms to reduce chances of falling, slipping, or receiving electric shock. This approach has been the major factor in the reduction of industrial accidents in modern factories.

The psychological approach involves the correction of the human factors in accidents. Training men to use safety methods and to become aware of hazards, developing attitudes of co-

operation, reducing fatigue, and properly selecting men for their occupations are psychological aspects of accident control. The importance of the psychological approach in accident prevention is illustrated by the fact that the organization of safety committees has been accompanied by reductions in accidents. From 1927 to 1931, the accident frequency of seventy-eight factories fell off more than 28 per cent, due primarily to the work of such committees.[4] Accident severity was also greatly reduced during this period.

Since men must use safety devices, the engineer's approach also gives rise to psychological problems. For this and other reasons it is apparent that the psychological problems cannot be separated from the purely mechanical ones.

MECHANICAL SAFETY DEVICES

The designing of safety devices is largely an inventor's problem, and some operations must be greatly altered to permit safe procedures. Like the motion and time engineer, the safety engineer must have originality and mechanical ingenuity. However, there are certain general principles which apply to most situations and which serve as points of departure for further improvements. A common method involves the use of guards which do not admit a part of the body, but do admit material to be brought next to the cutting edges of the machinery. Another approach involves the use of contact switches which break the electric circuit, so that the hands must be occupied with pressing buttons if the machine is to remain in operation. Protective devices, such as special gloves, glasses to protect the eyes, and special tools to hold the part that is cut or drilled, are familiar safety aids. Analysis of the type of accident associated with a particular job will suggest the danger points and raise specific problems for solution.

The purpose of safety devices is to eliminate the danger points; each one may be designed to remove a specific hazard. For this

[4] Vernon, *op. cit.*, pp. 268–272.

reason all safety mechanisms may be different. Safety devices also have certain common features, however, as well as certain specifications which must be met if they are to be satisfactory. The three most important psychological qualifications of all safety devices are discussed below.

GOOD SAFETY DEVICES CANNOT BE DISENGAGED

A psychological problem arises when men are required to use safety devices, for many men like to do the job in the old way and fear that they may appear to be timid if they seem afraid to take chances. They feel that the gadget slows production, and that they are experienced enough to get along without the safety accessory. Because of such reactions, men must be educated to respect safety methods. Moreover, safety devices should be designed in such a way that they cannot be disengaged. The device which interrupts the electric current and prevents a machine from running when the hands are not on the safety button would seem to be of such a character. However, men circumvent the safety feature of this device by using pieces of stick to keep the electric buttons depressed.

The best kind of safety device is one which is so arranged that the workers must use it in order to produce. When this sort of arrangement is impossible, psychological motivation must be introduced. If educational programs are inadequate, extra pay can be given to those who co-operate. When men are trained from the outset to operate a machine with a safety device, this problem is less likely to arise. New men can learn the safe way to work without having to overcome old habits. Training methods should be such that they develop an appreciation for the safe methods of operating a machine.

GOOD SAFETY DEVICES ARE FOOLPROOF

A second qualification of a safety device is that it be foolproof. A device that is only fifty-per-cent safe may actually increase the

number of accidents because the worker may consider it safer than it really is and become less cautious than he was before it was installed. Men tend to adjust themselves to the degree of danger they know to be present, and, if danger is made less apparent by safety devices, the number of accidents may be increased.

The adjustment which people make to the apparent danger of a situation is shown by the movement of traffic. The speed of driving determines the distance between cars because, at various speeds, the traffic is spaced roughly according to ability to stop the car. One can actually move more cars through a bottle-neck in traffic at a speed limit of twenty miles per hour than at a higher speed, because the cars will be spaced more closely together.

One of the important reasons why speed of driving is so closely associated with automobile accidents seems to be the erroneous judgment of safety. When traffic is light and the road is straight, the driver underestimates the hazard of speed. Automobile accidents in England were found to decrease in number as traffic density increased and thereby made the hazard more apparent.[5]

Another example of adjustment to known hazard may be cited. In electrical installation work, it was found that accidents occurred because inspectors sometimes pressed high tension bars with their flashlights. Exchanging the fiber-barreled flashlights for metal ones overcame this source of accident. Since the metal cases obviously were conductors, the men adjusted themselves to this property and avoided making contacts with their flashlights. The fiber-barreled flashlights were nonconductors for low voltage, but conductors for high voltage, and the men did not adjust themselves to the limited degree to which the fiber cases were safe.[6]

Since men adjust themselves to danger, points of hazard should be made apparent if they exist. Safety devices which guard completely against one type of accident may leave other sources of danger untouched. The use of safety devices may actually change

[5] Vernon, *op. cit*, p. 120.
[6] A. Ford, *Scientific Approach to Labor Problems*, p. 158.

the form of accident in a factory by protecting the worker from one hazard and, at the same time, making him unaware of others. Hazards which remain should always be made clear to the workers while they are being trained so that they do not overestimate the value of any safety measures.

A GOOD SAFETY DEVICE SHOULD NOT INTERFERE WITH PRODUCTION

Safety devices which interfere with work are unsatisfactory both because workers resist using them and because management objects to the loss in production. It should be the goal of safety engineers so to construct safety devices that they do not handicap the work pattern. Actually, the work pattern may be improved by the motion analysis which is involved in planning such devices. With the development of proper devices, production may be expected to increase because the worker can apply himself entirely to his work instead of having to divide his energies between personal care and work, a situation which rapidly induces fatigue. When a man must work under hazardous conditions, the nervous strain is also very fatiguing. When these two sources of fatigue are removed, the workman will have more energy to devote to production. Even those safety devices which actually increase the complexity of the work pattern may give rise to increased production because of the other savings in energy which have been made. In general, safety devices not only pay direct dividends in accident prevention, but indirectly lead to increased production.

INDIRECT SAFETY MEASURES

ELIMINATION OF FATIGUE

In Chapter 14, it was seen that accidents increase during the day and show a relationship to the fatigue trend. To the extent that fatigue and accidents are related, methods of fatigue reduction will reduce accident rates. That fatigue is most conducive to accidents when it is extreme is indicated by the difference in the effect of long and short days on the accident rates of men and women.

During World War I, a shell factory in England changed from a twelve-hour day to a ten-hour day. This change did not materially alter the accident rate among men, but it reduced the accident rate among women by more than 60 per cent.[7] During the recent war emergency in this country, women have been extensively employed, and their accident record is about 45 per cent higher than that of men. A good deal of this high accident rate among women is attributable to accidents which occur after the seventh hour of work.[8]

The relation between fatigue and accidents is not limited to the purely physical aspects of fatigue which result in loss in skill, but includes such psychological factors as absent-mindedness and inattention which arise because of boredom.

The weekly accident trend follows the production trend. Both the beginning and the end of the week show high accident frequencies. The correspondence between accident figures and production rates shows that efforts to improve accident records will pay dividends in production.

PROPER SPEED OF WORK

Analysis of hourly accidents reveals that, as the speed of work increases, there is a rise in accident frequency.[9] The influences of fatigue and speed of work on accidents are difficult to separate, but the presence of some correspondence between the amount of hourly production and accidents shows that speed must be a contributing factor. Unlike those of the day shift, night-shift accidents are high at the outset and follow neither the production curve nor progressive fatigue tendencies. The mental and physical state of the night-shift worker seems to be sufficiently different to change the accident trend. He comes to work more excited, but, as he continues on the job, he becomes more attentive and

[7] Vernon, *op cit.*, pp. 67–68
[8] A. G. Mezerik, "The Factory Manager Learns the Facts of Life," *Harper's Magazine*, 1943, *187*, 289–297.
[9] Vernon, *op. cit*, pp. 89–99.

settled; as a consequence, his accidents decline and his production rises as he stays on the job.

If fatigue and speed of work both contribute to accidents, it can be seen that pacing the work should do much to reduce accidents as well as to increase production. On the other hand, speed-up methods and overtime work are responsible for many accidents.

GOOD LIGHTING

In the next chapter we shall see that lighting is related to fatigue and so contributes to accidents. It undoubtedly also contributes to accidents in a more direct manner, but data on the subject are limited and inadequate.

On the average, accidents are about 25 per cent greater under artificial lighting than under natural lighting, but these figures are influenced by seasonal variations. Day- and night-shift work also involve differences other than lighting. There is no question about the fact that automobile accidents occur most frequently at dusk and that night driving is more hazardous than day driving.[10] That poor lighting may cause other forms of accidents is generally agreed, but careful industrial studies with specified illumination conditions are not available.

CONTROLLED ATMOSPHERIC CONDITIONS

Both temperature and humidity have been shown to be directly related to accident frequency.[11] In mining, there is a progressive increase in minor accidents as the temperature in different pits ranges from 62° to 85° F. In pits having the highest temperature, the minor-accident frequency was over three times that of pits having the lowest temperature. Major accidents showed little relation to temperature, however. For machine work the optimum temperature for the English worker is 67.5°. An increase of

[10] H. R. De Silva, *Why We Have Automobile Accidents*, pp. 18–21.
[11] Vernon, *op. cit.*, pp. 75–85; also M. Viteles, *Industrial Psychology*, pp. 364–368

35 per cent in accidents is obtained by a drop in temperature to 52° or a rise to 75°. Accidents of men and women are affected similarly by temperatures, except that high temperatures influence women somewhat less than they do men. It is probable that optimum temperatures vary with the way the worker dresses and the temperature to which the worker is accustomed in his home. For these reasons the optimum temperature in this country may be somewhat higher than that in England. The important point, however, is that optimum temperatures exist, and that these should be determined.

It is probable that conditions which are optimum for production will also favor the reduction in accidents. The problem of atmospheric conditions in relation to production will be considered in the next chapter.

PSYCHOLOGICAL SAFETY DEVICES

SAFETY COMMITTEES

Each plant should have a safety committee; also a number of subcommittees, if the number of employees is large. The personnel for such committees should include workers, as well as a safety officer, who should serve with the committee. Such a group, if it meets regularly and obtains reports, complaints, and suggestions from workers, can keep alive an interest in safety. National organizations exist and various plants could send representatives to the meetings of such organizations. A committee of this sort can serve in an educational capacity, as well as discover careless workers and potential hazards. Suggestions from workers have frequently led to constructive safety measures. With an active committee, social pressure will make unpopular the worker who declines to use safety measures and is generally careless. A man will not feel like a "sissy" when he gets first-aid treatment for a scratch if this behavior becomes a custom.

A safety committee can do a great deal to promote an educational policy and participate in safety campaigns. In many

plants active safety measures are new and must be "sold" to the workers.

SAFETY CAMPAIGNS AND POSTERS

The use of posters and slogans is desirable. However, as in all advertising, the appeal should be simple, reasonable, and constructive. A statement such as "Only fools are careless" is untrue and unreasonable. Emotional appeals may have temporary value, but, if they arouse fear, they may do more harm than good. A frightened worker is not a safe worker. Although a gruesome picture invariably attracts attention, it seldom creates a desirable effect. It is inadvisable to use posters showing agony in the face of an injured worker, a pair of hands dripping with blood, the mutilated body of a child, and the like, because these themes are not constructive; they arouse fear and pity more than they educate.

Perhaps the most important aspect of an effective poster is that it gives a positive message. "Don't kill a child" may be startling, but one doesn't really have to convince people of the advisability of such conduct. Such a statement actually suggests the possibility of doing it. Various investigations have shown that a negative statement gives one the idea of doing the very thing mentioned. If it is suggested that you do not put your tongue against your teeth, you want to do it. Telling children to leave a box closed is more effective in keeping it closed than telling them not to open it. Advertising a remedy for cold feet has more appeal when the description is headlined with "warm feet" rather than with "cold feet." People with cold feet respond to the goal of warm feet and are not attracted by a discussion of cold feet. A poster which tells you not to have accidents neither describes what you want to have nor tells you *how* not to have the accidents.

Posters which tell you that you can avoid accidents, that you must use protecting guards, that you must be thoughtful and careful, employ positive statements. Specific forms of behavior

which are conducive to safety can be advertised in appropriate departments and serve a constructive purpose. Merit ratings may also include evaluations on safe and considerate behavior, thus making safety a sign of proficiency.

The only value of negative statements in education is that they serve to explain by contrast or by illustration. Education, however, is fundamentally a positive process and teaching procedure should always lead to a positive goal. Specific methods which show *how* this goal may be attained should be included in the educational program. A campaign to reduce accidents by a specified number and a group decision (see pages 264 ff.) to reach this quota should serve a valuable purpose. By progressively improving the accident record and recording the results in terms of the decrease, it would be possible to make interest and social pressure function in a constructive manner. To avoid accidents is a negative goal, but to achieve safety is a positive goal. Information on how to behave safely is constructive and educational in that it tells how the goal can be attained.

SAFETY HABITS

In the discussion of skill (Chapter 11), emphasis was placed upon the desirability of stabilizing the efficient behavior pattern and building it into a strong habit. This notion may now be expanded to include safety as another characteristic of the habit. There are certain ways of holding a tool, specific body postures, and a few methods of applying pressure which are relatively safe, even if slippage or inaccuracies occur. On the other hand, certain movements which are unrelated to the job expose the person to injury and should be eliminated. The proper methods of work should be studied and taught to new employees. Such actions as assuming a posture which allows a man to lose his balance if a wrench slips; holding a finger in line with a cutting edge so that a finger injury occurs if there is a moment's inattention, or if an error is made; standing in a position so that the head is bumped if

the worker moves suddenly or without thinking; and holding the face too close to a grinding wheel so that particles of steel may injure the face are examples of behavior elements which should be eliminated from the work pattern.

The motion and time engineer should consider his problem as one involving safety as well as efficiency. Sometimes he may have to add elements to the pattern, such as the act of holding the balance with the free hand while applying force with the other, the habit of placing one hand behind the back while engaging the motor with the other, the use of the foot to guard against hot objects, and the routine of automatically putting on safety glasses or engaging a safety guard before touching the machine. These safety adjustments should become as much a part of the work pattern as snapping the polishing cloth is to a bootblack.

Artificial safety habits tacked upon an operation may interfere with the work and even create a new form of hazard. A common illustration of this kind of safety measure is the motorist's custom of putting the hand out of the window to signal a turn or a stop. At the very time when he must use one hand for signaling, he ought to have both hands for driving. If the window of his car happens to be closed, the habit is disrupted; in addition, he may hurt his hand. He then cranks at the window violently and, in his excitement, becomes confused. Soon he signals only part of the time and has no consistent response. All this extra activity requires attention if the driver is to show the correct safety behavior, and it occurs at a time when the attention should be on driving. Signaling a turn should be part of driving, not an addition to it. To train drivers to move to the middle of the road for a left turn, toward the right curb near the end of the block for a right turn, and toward the right curb of the middle of the block for stopping would aid their driving skill as well as incorporate the safety measure of signaling other cars. As a matter of fact, most drivers depend more on the action of the car for their warning than on the hand signals when they adjust themselves to the car ahead.

The study of various industrial operations from the point of view of safety can lead to the building of habits which are highly dependable and natural. These habits may be thought of as *psychological safety devices.* Like the design of mechanical safety devices, the design of safety habits requires thought and ingenuity.

When safe work habits have been made a part of the work pattern, it is unnecessary to warn employees to attend to the danger in their work. They can relax with the assurance that their habits will automatically make their actions safe. An illustration of the importance of stabilizing safe work habits is the method used by many electricians. Wiring can be done in a building with the current either off or on, but the procedure is different under the two conditions. It might be supposed that the current should be turned off whenever possible in order to avoid unnecessary injury. However, the electrician is not allowed to turn off the current. Since he is forced to work with live wires on all occasions, he must constantly use one procedure. This being the case, his habits become stabilized. With a single procedure, he does not constantly have to be aware of whether or not he is working with live or dead wires. Accidents caused by the workman absent-mindedly handling a live wire are largely prevented by this method. It may be desirable to eliminate the behavior of absent-mindedness, but this is difficult to do. Telling a person not to be absent-minded is little more effective than telling him not to be the kind of human being that he is.

Safety habits can stabilize the method of work, and to encourage this stabilization is to increase skill and, consequently, production. Training in safety habits should begin at the outset and be part of the employee training program. In many cases, the chosen pattern of work may not be superior to others, but safety demands that one method be used exclusively. Suppose five different things have to be done to cut out the current in a line. As long as they are all done, the job is satisfactory. If they are always performed in the order A–B–C–D–E, accidents arising from various

sources may be avoided. First, one man can take over where another left off without the possibility of any misunderstanding as to what things remain to be done. Secondly, the man can be interrupted after finishing item C, and, on his return, he can orient himself by discovering that C has been done. He need not recheck all the work or expose himself to the error of supposing he has finished something when he has not. Finally, the man need not think about all five points, since he has a routine which he can follow without constant attention. Everyone is subject to making errors by thinking he has done something when he has not or thinking he has not done something when he actually has. Thus, the order A–B–C–D–E may have no more virtue than the order E–D–C–B–A, but the essential feature is that an order has been followed, and this order can become a habit.

Habits are strong and dependable. These properties of a habit become apparent if we try to oppose them. Suppose, for example, that the doors which we have been using open easily by turning the knob clockwise and then pushing. If the lock on a particular door were changed so that we had to turn the knob counterclockwise, many of us would so depend on the door opening that we would bump our noses before discovering the error. To go through the particular door, each one of us would constantly have to think so as to differentiate this particular door from others. Even after making this adjustment, a little excitement would reinstate the difficulty and the bruised noses. Thus, habits are forces which may make us do foolish things, but they can likewise be made into forces which make us do safe things.

ACCIDENT–PRONENESS

SPECULATION CONCERNING THE DISTRIBUTION OF ACCIDENTS

When raising the question of how accidents are distributed in the population, a number of possibilities arise. It may be assumed that accidents distribute themselves on a chance basis so that everyone is equally subject to them, and that having or not having

accidents is a matter of bad or good luck. It may also be assumed that accidents follow a fair and just pattern. If you have had one accident, you have had your quota for a while, and it will be someone else's turn next. Further, it is reasonable to assume that having an accident so upsets the individual that he will tend to have future accidents because of a loss in confidence. Finally, there exists the possibility that some individuals are so constituted that they are destined to have accidents because of their biological and psychological makeup.

These four possibilities can be tested by examining the frequency of accidents of different people over a given period of time, or by studying the accident record of the same group of people during two separate periods of time. If accidents are a matter of chance, then a small number of people would have extremely few accidents, a similar number should have many accidents, and the majority should have an intermediate number. If the same group of people are compared on two successive years or months, the accident record of each individual during one period should bear no resemblance to that of the other period. If accidents are a matter of justice, then a comparison of the accident records of the same people during two periods should reveal that those having a high accident record on the first period would have a low one on the next. If accidents increase one's susceptibility, then people with accidents during one observation period should have relatively more during the next observation period. Finally, if accidents are due to the traits of people, then those making a certain accident score during one period should tend to duplicate the score on the next occasion.

RESULTS OF INVESTIGATIONS

One of the earliest studies bearing on these problems dealt with an analysis of the distribution of accidents among 648 women employees in a shell factory.[12] The distribution of accidents ob-

[12] M. Greenwood and H. M. Woods, "The Incidence of Industrial Accidents with Special Reference to Multiple Accidents," *Indus. Fat. Res. Bd.*, 1919, Rep. no. 4, 28.

TABLE 8. DISTRIBUTION OF ACCIDENTS
(From Greenwood and Woods)

Number of Accidents	*Number of Women*	
0	448	622 women had a total of 216 accidents, or 96 per cent of the women had 72 per cent of the accidents.
1	132	
2	42	
3	21	26 women had a total of 85 accidents, or 4 per cent of the women had 28 per cent of the accidents
4	3	
5	2	
Total	648	

tained is shown in Table 8. It will readily be seen that this does not conform to chance expectancy. On the basis of chance, only 8 per cent of the women should have between three and five accidents. That 96 per cent of the women should have only 72 per cent of the accidents, while 4 per cent of them have 28 per cent of the accidents suggests that accidents tend to happen to certain people.

Another approach, cited in the same investigation, involved the comparison of the accident frequency of 198 women during two successive periods. This analysis revealed that 136 women had no accidents during the month of February, whereas 62 women had one or more accidents (an average of 1.3 accidents) during the same period. From March to July, the 136 women in the no-accident group had an average of .16 accidents per month, whereas the 62 women in the accident group had an average of. 35 accidents per month, or more than twice as many. This finding reveals that accidents not only fail to follow a chance pattern, but that they tend repeatedly to involve the same individuals. There is, then, no external justice which evens out the "bad luck."

That the accident rates of the women during the second period do not exceed those during the first period indicates that there is

no increase in the tendency to have accidents. This fact reveals that accidents are not associated with the same individuals because a previous accident tends to have some kind of detrimental effect on a person which makes him more susceptible. To explain the facts, there remains only the possibility that accidents are associated with certain people because they have behavior characteristics which make them accident-susceptible.

The importance of the individual's characteristics in the incidence of accidents is also apparent when the relationship between two separate accident records of a group of individuals is measured. To indicate this relationship, accident scores of one observation period may be plotted against the scores of a second period. Correlation coefficients indicating the extent of relationship between two such periods commonly range from .37 to .72. When two measures show such correlations, it means that the scores have a common factor, which, in this case, is the person's susceptibility.

The inescapable conclusion from evidence of this nature is that some people are so constituted that their very nature causes them to bring about accidents and so to injure themselves as well as others. Such individuals are known as *accident-susceptible* or *accident-prone* persons. People differ in the degree to which they are accident-prone in the same way that they differ with respect to other traits.

The fact that the relationship between accidents during two observation periods is not perfect reveals that other factors, as well as individual susceptibility, contribute to accidents. An example of a similar relationship of factors is found in the relation between the height and weight of men. Height and weight are correlated imperfectly; we know that height contributes to weight, but we know also that it is not the sole factor in determining weight. In the same way accidents are dependent upon an individual's susceptibility, but other factors also operate. The extent to which these other factors operate will vary for different types of work, but the fact remains that all kinds of work reveal

the presence of accident-susceptibility to a lesser or greater degree.

A comparison of accident scores of a group of persons in one situation with those in another situation does not show as close a relationship as does a comparison of accident scores of the same persons over two periods in the same situation. This means that certain individual characteristics make for greater accident-proneness in one situation than in another. Nevertheless, some degree of relationship is always present. Even the frequency of home accidents and factory accidents reveals a correlation of .2 to .3.[13] A correlation between such dissimilar situations demonstrates the underlying importance of the individual in accident incidence; at the same time it shows also that the accident in one situation does not create a condition which causes accidents in other situations.

Investigations of accident distributions have shown also that accident-proneness does not operate merely in hazardous types of work. Although different occupations show varying degrees of hazard, the relationship between accident rates on two successive periods holds for all occupations.[14] The hazard of an occupation, however, must be considered when evaluating an accident record. A record of five hospital visits for a crane operator may show a lesser degree of proneness than that of four hospital visits by a metal-sheet inspector. The accident-prone individual is always susceptible, but how often the accidents occur depends also upon accident-opportunity.

Accident-proneness may be regarded as a combination of human abilities which make a person highly proficient in bringing about accidents. In the same way that certain human traits destine a man to have aptitude for learning a trade or operating a machine, so other patterns of traits destine some men to be inclined toward having accidents. Training can influence both types of aptitudes, but basic differences between people must be recognized.

[13] E. M. Newbold, "A Contribution to the Study of the Human Factor in the Causation of Accidents," *Indus. Fat Res. Bd*, 1926, Rep. no 34, 74.
[14] Tiffin, *op. cit*, pp. 288–290

As the rate of improvement in learning serves as an index of potential ability on a job, so an early accident record may be used as an index of the degree of ability to have accidents. The removal of persons who have a high accident record during their first year would materially reduce accident incidence. Since minor accidents are more numerous than major accidents and, at the same time, reveal the accident-prone individual, it is highly important to keep a record of all accidents. The tendency of some managements to overlook minor injuries results in the loss of valuable data.

TESTS OF ACCIDENT-PRONENESS

INTRODUCTION

Since its original discovery, a large number of investigations have demonstrated that accident-proneness is an important factor in the cause of accidents. The concept also checks with experience as soon as one discounts the view that accidents are a matter of bad luck. We all know of clumsy and unhandy people who drop or break almost everything they touch. Frequently, these are the individuals who consistently have automobile accidents and who criticize insurance companies for cancelling their policies. To these individuals, an accident tends to be someone else's fault; although this is sometimes the case, the individual with recurring accidents is making a personal contribution toward a good many of them. That he tends to blame others indicates poor emotional adjustment.

It is perhaps desirable to differentiate between accidents which are caused by a person's tendency to get into accident situations and the ability to avoid an accident when in an accident situation.

The fast driver or the driver who neglects to check his brakes may get into accident situations but may show unusual skill in manipulating his car and thus avoid a collision. He may describe how he figured it all out and used his head to solve a difficult problem, but, actually, this thinking probably represents a rationaliza-

tion of his actions after he has made the successful reactions. When in an accident situation, such a person may be quick to see an opening. He may drive his car into a low ditch and come out of it just in time to miss a culvert, thus avoiding a collision with a stalled car ahead of him or with a car approaching from the opposite direction. But this does not mean that he planned all the details before he drove into the ditch. His skill and rapid perception saved him, but, if he persists in getting into such situations, he will acquire an accident record. Another individual may carefully avoid accident situations, but, when he is in one, he may either lack sufficient skill to cope with it or be the type that goes to pieces and loses whatever skill he possesses. Such a person also acquires an accident record, because all accident situations cannot be avoided.

It is sometimes puzzling to find that some highly skilled individuals have more accidents than less-skilled persons. Actually, such individuals do not have the same accident exposure. The skilled person works on a narrower margin of safety and so is exposed to greater hazard. For example, young men may show greater skill than older men in handling a car, but at the same time have more accidents. Because of their superior skill, they may drive faster and allow less distance for passing other cars, so that, if something goes wrong, they have little leeway. The older man would have more accidents than the young man if he had to drive under the same conditions. That he has fewer accidents is not evidence of greater skill, but of his tendency to maintain a much larger margin of safety.

The above illustration suggests that accident-proneness may depend on a rather complex set of traits and that these traits need not be the same for all accident-prone individuals. However, if accident-proneness is to have any application to industry, it is necessary to determine the traits which are associated with accident-susceptibility and to develop tests for detecting their presence. Obviously, accidents can be reduced if accident-prone in-

dividuals are kept out of hazardous work. In this way the safety of others, as well as that of themselves, will be increased.

SENSORI-MOTOR TESTS

Measures of muscular co-ordination have been shown to be related to accident-proneness. In one investigation this group of abilities was measured by a dotting test, by speed in reacting to a signal, and by adjustment of muscular performance in accordance with changing signals.[15] When over six hundred employees were divided into two groups according to test scores, the poorer half of the test performers had 48 per cent more accidents than the better half. The poorer quarter had 51 per cent more accidents than the better three-quarters, indicating that the elimination of 25 per cent of the poor performers on such tests would accomplish a significant decrease in accidents. The relation between the test score and accident rate was also present when the data were analyzed according to the occupation of the employees. Other investigations have revealed similar relationships between motor co-ordination and accidents.[16] In one case the 25 per cent making the poor scores on a series of motor-co-ordination tests had twice as many accidents as the remaining 75 per cent. Correlations between test scores and accident frequency ranged from .10 to .44.

The relationship between test scores and accidents also increases with length of time on the job.[17] Apparently, the causes of accidents become more uniform with experience, and the sensori-motor tests reveal this persisting personal factor in accident causation.

Of great practical importance is the fact that there is a definite relationship between the above accident-proneness tests and proficiency on the job. By selecting employees who do well — that

[15] E. Farmer and E. G Chambers, "A Psychological Study of Individual Differences in Accident Rates," *Indus. Fat. Res. Bd*, 1926, Rep. no. 38, 46.
[16] Vernon, *op. cit.*, p. 40.
[17] E. Farmer, and E. G. Chambers, "A Study of Personal Qualities in Accident-Proneness and Proficiency," *Indus. Fat. Res. Bd*, 1929, Rep. no. 55, 84.

is, score low — on accident-proneness tests, accidents can be reduced and the caliber of the employees be improved at the same time.

In so far as sensori-motor co-ordination is associated with accidents, it is reasonable to suppose that clumsiness, inadequate skill, slowness of response, and defective sense organs contribute to accidents. Individuals low in motor ability are unable to get out of accident situations without sustaining an injury; also, in many cases, they do not have the skill or sensory acuity to avoid certain kinds of accident situations. Such individuals may not be careless, irresponsible, or impulsive; yet they may be accident-prone.

EMOTIONAL STABILITY TESTS

Instruments which measure the degree of emotional reactions (in terms of glandular changes) and tests which measure tremor have been found to be effective in showing a relationship between certain aspects of emotionality and accident frequency.[18] The accidents of taxicab-drivers have been greatly reduced by the use of psychological tests, among which tests of emotional stability were found to be highly important.[19] Even closer relationships are found when an individual's responses are measured under disturbing and distracting conditions.[20] For example, taxicab-drivers who made five or more errors on such tests had an average of three accidents, whereas those who made less than five errors had only 1.3 accidents. Furthermore, considering only individuals who had no accidents, it was found that this accident record was attained by 46.1 per cent of the drivers who made no errors on the test, by 18.8 per cent of those who made from one to three errors on the test, and by 12.5 per cent of those who made five or more errors. Thus, the probability of being accident-free is nearly four times as great in the high-scoring group as in the low-scoring group.

[18] Farmer and Chambers, *op. cit.*
[19] A. J. Snow, "Tests for Chauffeurs," *Indus. Psychol*, 1926, *1*, 30–45.
[20] D. Wechsler, "Test for Taxicab Drivers," *J. Person. Res.*, 1926, *5*, 24–30.

Moods also seem to be highly important. In one study it was found that half of four hundred minor accidents occurred while the employees were emotionally "low," although this emotional condition existed only 20 per cent of the time.[21] Production was 8 per cent higher during the happy moods, showing that emotional conditions favorable to accident prevention are also favorable to production.[22]

The emotional factor may be related to accidents in two different ways: first, it may contribute to a loss in skill and thus interfere with the ability to get out of an accident situation safely; and, secondly, it may cause people to get into accident situations because they are preoccupied, discouraged, or careless. It is desirable that the emotional contribution be further analyzed so that these two types of influences can be separated. Other personality factors also may be important.

INTELLIGENCE TESTS

The same investigations which revealed that accidents were related both to sensori-motor co-ordination and emotionality showed no relationship between accidents and intelligence.[23] Other investigations, however, have shown some relationship with mental traits. In one study combined intelligence and emotional-stability scores were more predictive than emotional stability alone.[24] On the basis of test performance it was predicted that 34 men would be unsatisfactory and that 258 would be satisfactory. Performance over a ten-week period revealed that the employees labeled unsatisfactory on the basis of psychological tests had five times as many accidents per man as those labeled satisfactory.

Another study demonstrated a relationship between intelligence and accidents in a vocational school, but in this case it is difficult

[21] R. B. Hersey, "Emotional Factors in Accidents," *Person J*, 1936, *15*, 59–65.

[22] R B. Hersey, "Rates of Production and Emotional State," *Person. J.*, 1932, *10*, 355–364.

[23] Farmer and Chambers, *op. cit.*

[24] Snow, *op. cit.*

to know to what extent the intelligent students acquired skill more rapidly and so avoided accidents, and to what extent they were permanently less accident-prone.[25]

In data on automobile accidents it is frequently found that high accident records are associated with low mentality. It is probable that intelligence, when inadequate for the situation, is an important trait in accident-proneness. For example, it has been found that one-third of the cases referred for mental-hygiene study by the Traffic Court of Detroit were feebleminded (I.Q. 43–72).[26] When adequate intelligence is present, it may cease to operate as a factor. Since employees who are satisfactory in their work probably have the minimum intelligence requirement, their accident-proneness is more likely to be attributable to sensori-motor and emotional factors. Certainly the importance of intelligence in avoiding accidents has been overrated in the popular mind. Accidents are not by any means confined to fools, as is commonly believed.

RATIO BETWEEN MUSCULAR AND PERCEPTUAL SPEED

In examining the characteristics of accident-prone and accident-safe individuals, it was found that the relationship between motor and perceptual speed was quite different in the two groups.[27] Individuals who were relatively quicker at recognizing differences in visual patterns than they were in making purely muscular manipulations tended to be accident-safe. Individuals who were relatively slower in recognizing visual patterns than they were in making muscular responses were inclined to be accident-prone. The relationship between the two tests can be expressed by subtracting the motor-test score from the perceptual-test score. When this was done, it was found that the 15 per cent of the workers with the poorest safety record all had negative scores. The

[25] M. S. Henig, "Intelligence and Safety," *J. Educ. Res*, 1926, *16*, 81–87.
[26] L. S. Selling, "Feebleminded Drivers," *Amer. J. Ment. Def.*, 1943, *47*, 337–341.
[27] C. A Drake, "Accident-Proneness: a Hypothesis," *Character and Person.*, 1940, *8*, 335–341.

striking effectiveness of this measure is also brought out by comparing scores on the test. It was found that 7 per cent of the workers made scores as low as −25 and that 7 per cent made scores as high as +25. All of the former had accidents, whereas none of the latter had accidents. Of the 42 per cent who made scores of −10 or less, 82 per cent had accidents. When this test was used in the selection of eighteen new employees, the accident index of the new group was 70 per cent below average. This reduction was obtained despite the fact that the plant had already obtained a low accident record by means of a safety program.

These findings indicate that people who tend to act more quickly than they can perceive are likely to have accidents. Motor and sensory tests alone fail to reveal this relationship to any marked degree; consequently, many nonessential factors are measured. The discovery of a few specific functions which show similar relationships would make possible the designing of accident-proneness tests which are highly diagnostic. As long as we do not know exactly what to measure, the test battery must be unnecessarily long, and the relationships limited in accuracy.

THE CLINICAL APPROACH TO ACCIDENT-PRONENESS

Viteles has emphasized the importance of carefully studying the accident-prone individual, diagnosing his difficulties, and recommending remedies.[28] By means of this approach, the accident rate of forty-four accident-prone motormen dropped from 1.3 accidents per thousand miles to .75, within one year.

In order to diagnose and treat accident-proneness, it is necessary to be able to recognize the symptoms in the individual and to know the most frequent causes of accidents. For this reason the types of accidents in a given occupation are carefully analyzed. Among motormen, for example, 64 per cent of the accidents were found to be caused by one of the following conditions in the individual: (1) faulty attitude; (2) failure to recognize potential

[28] M. S. Viteles, *Industrial Psychology*, pp. 376–389

hazards; (3) faulty judgment of speed or distance; (4) impulsiveness; (5) irresponsibility; and (6) failure to keep attention constant. The importance of each of these factors is in the order listed, the first appearing as the cause in 14 per cent of the accidents and the last as the cause in 8 per cent.

That this procedure is valuable is shown by the fact that its utilization reduces accidents. However, it must be recognized that such an analysis of accidents is largely subjective. To conclude, for example, that an accident is attributable to a faulty attitude is an interpretation of the facts rather than a statement of facts. The man who had the accident may actually lack the necessary co-ordination, a deficiency which may have caused him to develop an inferiority attitude. Because being on the defensive causes him to be anti-social, his attitude is judged faulty.

A similar source of error is present in psychological analyses which are based on human judgments. When two people are engaged in an argument, one may ask how it started, and be told that the cause was a disagreement over politics. Yet, behind this cause may lie the fact that the two men thoroughly dislike each other; the political issue might be quite incidental. These hidden factors do not come to light by analyzing the causes of arguments. Similarly, the analysis of accidents by this procedure has limited value and is not a substitute for methods which relate individual traits with accident-proneness. This is probably the reason why the testing method and the clinical method do not agree more closely on the nature of accident-proneness. For the present, it is desirable that both approaches be used. The testing method is particularly valuable in selecting employees, whereas the clinical approach is important in helping the accident-prone individual.

OTHER PERSONAL FACTORS RELATED TO ACCIDENTS

EXPERIENCE

Inexperience on a job is responsible for many accidents. One can hardly call this factor a form of accident-proneness, since it

AGE

Generally speaking, the accident rate declines with age, since increasing age is usually accompanied by increased experience. However, even if comparisons are made between men of equal experience, but differing in age, a general decline in accident rate with age has been found in the metal industries.[30] In coal-mining, the safest age is between thirty and thirty-nine years for coal-face workers and between twenty and twenty-nine for other underground workers.[31] In these cases advancing age beyond an optimum is accompanied by an increase in the accident rate. In the transportation industry a decline in safety does not occur with advancing age up to sixty-five years. Because age is associated with increased skill as well as with increased susceptibility to fatigue, it may be expected that the age factor will vary for heavy and light industries, and for complex and simple kinds of work. High temperatures may also affect older men to a greater degree than younger men and indirectly influence accidents.

The higher rate of accidents among young men is probably attributable to inexperience, as well as to impulsiveness and a willingness to take chances.

SEX

In general, women are somewhat more inclined to have accidents than are men. Even in taxicab-driving, where physical strength is not important, it was found that women had nearly three times as many accidents as men when mileage was equated, and three and one-half times as many as men when revenue was equated.[32] The common belief that women drivers have fewer accidents is based on studies which neglect to take into account different degrees of exposure. Whether the accident difference between men and women is one of experience or a basic sex differ-

[30] Newbold, *op. cit.*, p. 28. [31] Vernon, *op. cit.*, p. 57.

[32] M. S. Viteles, and H. M. Gardner, "Women Taxicab Drivers," *Person. J.*, 1929, 7, 349–355.

ence cannot be determined at the present time. Certainly, susceptibility to fatigue will remain as a sex difference.

HEALTH

Individuals who make frequent visits to the ambulance room for treatment of minor sicknesses tend to be accident-prone. There exists a distinct relationship between the number of such sickness visits and the number of accidents sustained. No relationship between accidents and illnesses which indispose the employee for work is found, however. Apparently, people with low vitality and great concern over their state of health tend to be accident-prone. High blood pressure is a specific condition which is associated with accidents among streetcar motormen.

Mental symptoms also are highly important. Many accident-prone individuals are neurotic, high-strung, and temperamental. The fact that accident-prone individuals are inclined to be uncooperative and anti-social also suggests the importance of good mental health in accident prevention. An accident clinic can do much to aid such individuals in making healthy social adjustments.

GENERAL CONCLUSIONS

Although the careful analysis of accidents is relatively new, sufficient is known to demonstrate that accidents have their causes and that these causes can be greatly reduced in number. Opportunities for accidents can be reduced by removing hazards, while individuals who are accident-prone can be placed in positions in which opportunities for major accidents, at least, are at a minimum. Proper training of workers and the analysis of their specific difficulties can reduce the degree of proneness in any given individual.

Although the utilization of what is already known can greatly reduce accidents, further advances can be made when specific occupations are more thoroughly analyzed. Since the human fac-

tors in accidents are both numerous and complex, each plant can gain much by studying the types of accidents with which it is confronted. This requires the keeping of careful records for all forms of accidents. Minor accidents and even errors in work may serve as useful indices or warnings. Because accident-prone individuals are, in general, not the most proficient workers, gains in production may be expected as a by-product of an accident-prevention program.

When a man has an accident involving loss in time, he must be replaced by another, who ordinarily is less experienced. Since experience on the job is associated with accidents, the substitute is highly accident-susceptible. Because of this fact, one accident tends to create a situation which is likely to produce another accident, even if the factors of fear and poor morale among employees in general are disregarded. A reduction in accidents has the opposite effect on the number of "green" men exposed, so that the prevention of one form of accident also reduces the accidents which are caused by inexperience. This is another by-product of a safety program.

Considering the direct and indirect benefits, there seems little doubt that an efficient accident-prevention program would pay high dividends and that these dividends would continue to mount as the program was expanded. The increase in good will and improved morale would also have a financial value, but these contributions are too complex to measure.

17 THE WORKING ENVIRONMENT

ILLUMINATION

INTRODUCTION

The lighting arrangements of the factory are the particular problem of the lighting engineer, but a number of psychological questions arise which are the concern of the plant manager. One cannot judge the adequacy of lighting merely by trying it out on oneself, so it is necessary that careful tests of human performance be made under different lighting conditions in order to determine optimal conditions.

Since the human eye has a remarkable ability for adjusting to illumination, even relatively great differences in lighting may not be noticed. For instance, out-of-doors, on a clear midsummer day, from eight thousand to ten thousand foot-candles of light may fall on a given surface, making it about two thousand times as bright as it would be when viewed in an office which is well illuminated by means of artificial light, yet the difference may not be particularly noticeable. However, the difference between shaded and exposed areas out-of-doors is readily noticed, although the difference in brightness in this case may be only in the ratio of 1 to 10. One notices the difference between shaded and non-shaded areas relatively more than the difference between indoor and outdoor areas because the eye makes necessary adjustments when the individual is entirely in one illumination or another. A little experience with light meters and cameras will further demonstrate

to the reader the deceptiveness of human judgment with respect to differences in illumination.

A foot-candle of light is approximately the amount of illumination a person would obtain on a completely dark night if a hundred-watt lamp were placed ten feet above his head. Indoors, the ceiling and walls return a good deal of light which is lost outdoors, the amount of this reflected light varying with the color of the surfaces. White surfaces reflect 80 to 85 per cent of the light which falls upon them, while medium gray reflects 20 to 40 per cent. Such colors as light green and sky blue reflect approximately 40 per cent of the light they receive; and cardinal red, about 16 per cent. The lighting of a factory can be greatly improved by the use of light-colored paints.

In considering proper lighting, it is necessary to take into account the distribution of light, the intensity of the light, and its wave-length (color). Although each of these aspects has its own specific advantages, they are somewhat interdependent. For instance, increase in intensity alone may be a disadvantage if glare effects are thereby increased.

THE DISTRIBUTION OF LIGHT

The adjustment of the eye to illumination varies with the total amount of light which the eye receives and not merely with the amount of light which strikes the eye from the working surface or from the object under observation. Even when one eye is closed, the other eye must adjust to the reduced visual stimulation. In considering the adequacy of illumination, it is necessary to take into account the lighting of the *total visual field* rather than the lighting of the *field of observation*. For instance, the light from the sky may be brighter than that at the worktable, so that, if a person is facing a window, his visual mechanism adjusts to the combined value of the light rather than to that of the work space alone. If one eye receives more light than the other, the adjustment is similarly disturbed, since neither eye is adjusted to its specific

illumination. The practical implication is that the whole area should be uniformly illuminated, although the working surface may have some additional light. Walls which have poor reflecting qualities reduce the illumination of the outer parts of the visual field, so that, even though a large amount of light is used in the room, the total field is not uniformly lighted.

A second reason for avoiding variations in the lighting of the total visual field is the tendency of the eyes to fixate high points of light. When these points do not coincide with the focus of the work, opposite muscles — that is, muscles opposing those which effect the fixation of the points of light — must overcome the tendency of the eyes to turn away from the work. For example, when a person is asked to look at a dark space between two high points of light which are placed some distance apart, he not only has difficulty in doing so, but soon shows discomfort and fatigue.[1] The cause of this fatigue is the tension produced in the opposing sets of muscles which control eye movements. Since the eyes tend to move from one light to the other, general tension in the muscles is necessary to keep them fixed.

Another source of fatigue arises when the illumination changes too rapidly for the pupillary contractions and relaxations to follow.[2] Flashes of light occurring in rapid succession quickly produce fatigue and eye strain. In this case the strain occurs because of the tension of opposing pupillary responses. A similar condition arises when the eye passes over an area of varied illumination, as occurs when there are highly polished objects in the visual field. Such objects should be removed or painted.

Eye fatigue was once thought to be caused primarily by the excessive use of the eye muscles in controlling vision. However, we now know that a more common cause of such fatigue is the tension which arises when opposed movements are simultaneously stimulated, thus creating a conflict. Since eye fatigue and discom-

[1] S H. Bartley, "A Factor in Visual Fatigue," *Psychosomat. Med.*, 1942, *4*, 369–375.
[2] Bartley, *op. cit.*

fort are important factors in reduced production, their causes should be eliminated.

Variation in the illumination of the visual field is also a source of shadows, which interfere with the desired contrast between the different parts of an object which must be distinguished. It is likewise responsible for various forms of glare which are caused (1) by excessive stimulation; (2) by an overlay of scattered light; and (3) by reflections of light from the working surface out of the focus of the eye. Both glare and lack of contrast interfere with good vision and are sources of irritation. Inability to sustain good vision is likewise a source of errors and accidents; whereas fatigue and discomfort slow down production and cause irritability as well as errors.

Indirect lighting is the best method for producing uniform illumination. In this type of illumination, all of the usable light is reflected light; high points of light, caused by light from the bulb striking the eye directly, are out of the visual field. Semi-indirect lighting reduces the high point of light by means of milk-glass or ground-glass shields, and utilizes a good deal of indirect light which is made available because these shields reflect considerable light to the walls and ceiling. The condition is further improved if the sides of such globes are guarded by opaque screens. These prevent direct light from striking the workers' eyes, but permit it to pass to the ceiling or directly down on the work. With the source of light directly overhead, it cannot strike the workers' eyes unless he purposely looks up at it. In direct lighting, the source of the light is concentrated at small points; thus, shadows, glare, and high points of light are at a maximum. Vapor lamps avoid these difficulties to a considerable degree because the source is less concentrated. Thus, lighting by vapor lamps is similar to semi-indirect lighting methods; moreover, it is less costly.

The disadvantage of indirect lighting is its cost, since considerable light is lost through absorption. The benefits of indirect light, however, seem to be more than worth their extra cost. In a three-

hour reading test, little fatigue and practically no change in the ability to sustain clear vision were found under conditions of indirect lighting. Direct lighting was the most unfavorable condition, while semi-indirect lighting produced effects more similar to direct than to indirect lighting.[3] These findings suggest that, in improving lighting, it is better to go all the way to indirect lighting than to stop at a midway position, particularly when the work requires sustained and detailed vision.

Further studies will undoubtedly suggest improved methods for obtaining uniform light distribution. The height and the shape of the ceiling and the height of the light sources will alter the effects of both direct and indirect lighting methods. Enough is known, however, so that in most instances the lighting engineer can institute marked improvements.[4] A low ceiling, highly illuminated by indirect lighting, might bring the bright ceiling into the field of vision. Because conditions of this sort, as well as many others, influence the end result, broad generalizations cannot be made without taking into consideration the work situation, as well as the type of work.

ILLUMINATION INTENSITY

Visual acuity increases with light intensity and is about equal to daylight acuity as one hundred-candle-power intensity is approached. However, this degree of acuity is seldom required, and it is apparent that the desired amount of lighting will vary with the amount of detail in the work. For instance, for very fine work, such as distinguishing black thread on black cloth, intensities of four hundred foot-candles have been recommended.[5]

Results of surveys made in attempts to determine the minimum needs of light intensity for different jobs show striking inconsistencies. For example, in such occupations as office work and

[3] C. E. Ferree and G. Rand, "Lighting in Its Relation to the Eye," *Proc. Amer. Phil. Soc.*, 1918, *57*, 440–478.

[4] P. H. Moon, *The Scientific Basis of Illuminating Engineering.*

[5] M. Luckiesh and F. K. Moss, *The Science of Seeing*, pp. 308 and 345.

fine lathe work, the estimates for minimum illumination range from three to twenty or more foot-candles.[6] The recommended illuminations in the lower estimates are also much lower than the minimum requirements of the higher estimates. In view of the fact that, in general, the estimates of desired intensities are higher in the more recent studies, it seems probable that in most industries the light intensities used are much too conservative. Industrial surveys indicate that production continues to rise as illumination is raised from six to twenty foot-candles, and that at twenty foot-candles the rise in production follows a sharper upward trend than does the increase in the cost of lighting.[7] Since production still rises at twenty foot-candles, it may be assumed that the optimum returns for adequate lighting have not yet been reached.

In general, industrial surveys show production increases ranging from 8 to 27 per cent with increased illumination, the actual increase depending upon the kind of work. That the type of work is a factor in the extent of the increase shows that the rises in production cannot be attributed entirely to an improved attitude, but that improved vision and reduced fatigue continue to increase production even when the lighting intensity greatly exceeds minimum requirements.

The cost of these improvements in lighting, calculated in terms of production, is less than five per cent, so that a net gain in practically all types of work may be expected.

In concluding this discussion of the intensity factor in illumination, we must point out that increased intensity must be accompanied by facilities for uniform light distribution. Increases in intensity may be disturbing if the light is not properly distributed. High illumination with direct lighting may actually be very disturbing.[8]

[6] A. T Poffenberger, *Principles of Applied Psychology*, pp. 150–151.
[7] M. Luckiesh, *Light and Work*, p. 267.
[8] Ferree and Rand, *op. cit.*

COLORED LIGHTS

The economical operation of vapor lamps makes it desirable to know the relative effectiveness of colored light for vision. Although there are some differences in the various findings, the results of recent careful experiments seem to be quite conclusive. When acuity, speed of discrimination, power to sustain clear seeing, and loss in visual efficiency were tested under spectral lights of equal intensity, it was found that for all four functions the middle of the spectrum was superior.[9] In nearly all cases the order of superiority was found to be yellow, yellow-green, orange, green, red, blue-green, and blue. For acuity the best part of the spectrum was 2.2 times more effective than the poorest, while for speed of discrimination the best color was 9.7 times more effective than the poorest. However, since light from a Mazda lamp was superior to any of the colored lights, the authors of the investigation warn against the extensive use of colored light.

In an experiment involving an actual industrial job — that is, inspecting white flannel cloth for defects — results of work done under three sources of light were compared. The light sources were an ordinary Mazda lamp, a "daylight" Mazda lamp (blue glass), and a mercury-vapor lamp (blue).[10] It was found that acuity was greatest under the "daylight" lamp and least under the mercury-vapor lamp (blue).

Although colored illumination seems to be less deficient when the whole visual field, rather than just the work space, is lighted by a light of the same hue, the findings in general favor the use of mixed or white light. With fluorescent light available, there seems little reason for continuing the mercury-vapor (Cooper-Hewitt) lamp. More economical lighting may also be developed by the proper use of reflecting surfaces. Screens and walls ar-

[9] C. E. Ferree, and G. Rand, "Visibility of Objects as Affected by Color and Composition of Light," Part I, *Person. J.*, 1931, *9*, 475–492; Part II, *ibid.*, 1931, *10*, 108–124.

[10] S. W. Fernberger, M. S. Viteles, and W. R. Carlson, "The Effect of Changes in Quality of Illumination upon Visual Perception," *J. Appl. Psychol.*, 1934, *18*, 611–617.

ranged around the work space so that they diffuse the light and give uniform white illumination to the whole visual field may do much to reduce the cost of indirect lighting.

EFFECTS OF GOOD LIGHTING ON MORALE

Good lighting is cheerful and stimulating. Undoubtedly, some of the improvement in production which results from proper illumination is attributable to the favorable attitude which is created by pleasant surroundings. Although individuals differ in the amount of light they find most desirable, 65 per cent of the subjects of one study judged intensities between ten and thirty foot-candles the most comfortable for reading.[11] This range in preference is not excessive. With fifteen or twenty foot-candles, the majority of individuals could work under a lighting intensity which was close to that which they found most comfortable; at the same time they would have an illumination which has been found to be highly efficient and economical from the point of view of production.

Invariably, people prefer light of daylight color. Since this light is also superior to all other lights in visual efficiency, ideal lighting would demand the use of correcting filters on filament lamps in order to obtain daylight color, as well as the discontinuation of colored vapor-lights. The use of white light also reduces the differences in the appearance of objects and people in daylight and artificial light, thus eliminating the necessity for workers to accustom themselves to the strange appearance of their surroundings. Further advances in matching the physical properties of daylight and white artificial light will gradually reduce the changes which colored objects undergo when viewed under the two sources of light.

[11] C. E. Ferree, and G. Rand, "Good Working Conditions for Eyes," *Person. J.*, 1937, *15*, 333–340.

ATMOSPHERIC CONDITIONS

THE VARIOUS ASPECTS OF THE ATMOSPHERE

There are a number of properties of the air which may be expected to influence the work of an individual, since he breathes the air and his body is immersed in it. These include: (1) the chemical composition of the air, which in a pure condition consists of 20.93 per cent oxygen, 79.04 per cent nitrogen, and .03 per cent carbon dioxide; (2) the addition of substances given off by people through exhalation and perspiration; (3) the temperature; (4) the barometric pressure; (5) the movement of the air; and (6) the humidity.

The *chemical composition* of the air is often a cause for concern because it is widely known that oxygen is inhaled and carbon dioxide is exhaled. It is commonly believed that, when a large number of people are in a room, the proportions of gases are so altered as to make breathing difficult. Because of this belief, people customarily open their windows at night to obtain fresh air.

That human beings give off poisons or that they deplete the oxygen supply are possibilities which must be checked by research. The presence of a large number of people in a room also raises the temperature as well as the moisture content. If a group of people make the air "foul," it is desirable to know the source of the "foulness."

The *temperature* of the air obviously influences body temperature. The body tends to maintain a constant temperature by reflex responses which lower or raise its temperature. In cool air, excessive heat is lost from the body by convection and radiation; this heat must be re-supplied relatively rapidly if the body is to maintain a constant temperature. In very warm air (warmer than the skin), on the other hand, the body absorbs heat from the surroundings; thus, it must be cooled by the evaporation of perspiration and the exhalation of heat through breathing. Atmospheric temperature, therefore, is a factor which influences the way the body must function to maintain a constant temperature.

Barometric pressure changes somewhat from day to day, but marked constant differences are present in low and high altitudes. When the pressure is low — that is, at high altitudes — the air is thin, and a person must breathe more air to get the necessary oxygen supply. The effects of barometric pressure on psychological functions are particularly important in aviation and in mountainous regions,[12] but under usual conditions the barometric variations are not sufficiently great to influence activity.

The *movement* of air prevents stagnant air from accumulating about the body or around machinery. Any undesirable property of such air (for example, its temperature or moisture content) is removed by its mixture with other air in the room. Circulation of the air prevents the formation of pockets of warm and moist air. It has been shown that in factories which do not have forced circulation there may be a great deal of variation in the cooling properties of the air in various parts of the same room, although the temperature difference may be very small.

The *moisture* content of the air may function in two ways. The heat conductivity of the air increases with humidity, so that on a cool day humid air rapidly carries heat from the body (convection) and the air feels cooler than the temperature reading would indicate. On the other hand, humid air interferes with the evaporation. Since the evaporation of perspiration serves a cooling function, this process is inhibited by high humidity. Warm, humid air feels warmer than its temperature warrants because it interferes with evaporation to a greater degree than it conducts heat from the body surface. At between 68° and 70° F., humidity is negligible in its influence on the bodily function of maintaining a constant temperature.[13]

THE EFFECTS OF THE AIR THAT IS BREATHED

Investigations made by the New York State Ventilation Commission clearly showed that the air which is breathed does not

[12] Poffenberger, *op. cit*, pp. 177–179.

[13] Poffenberger, *op. cit.*, pp. 166–168.

cause the symptoms produced by "bad" air, such as headache, drowsiness, and lassitude.[14] A number of people confined in an airtight chamber for several hours showed the symptoms only when this so-called "bad" air surrounded the body. Persons in the room who breathed "fresh" air through tubes showed the symptoms, and persons outside the room who breathed "bad" air from the room failed to show the symptoms.

The air that is breathed is harmful only when the oxygen content is reduced to 14 per cent and the carbon dioxide is increased to 2.4 per cent. Oxygen content seldom falls below 19 per cent and the carbon dioxide content rarely exceeds .3 per cent, even in poorly ventilated schools and factories, because enough air is exchanged through the walls and around windows to maintain fairly constant proportions.

The facts do not support the prevalent notion that symptoms of poor ventilation appear because "bad" air is inhaled. Body odor may influence some individuals who are highly sensitive to odors and the suggestion or belief that air is "bad" may affect others, but a knowledge of the facts will decrease these effects. For example, employees working in a building which had no windows, but which had an excellent ventilation system, constantly complained about the air. Their complaints and the symptoms disappeared when the modern ventilation system was shown and explained to them. This example indicates that suggestion is an important contributor to the ill-effects caused by breathing "bad" air.

Dust and foreign matter in the air may produce harmful effects on health as well as on attitudes, and such foreign matter obviously should be removed, perhaps by filters in the ventilating system. Such filters would also remove pollen from the air, thus reducing the incidence of allergic disturbances among the workers.

THE EFFECTS OF THE AIR SURROUNDING THE BODY

The New York Ventilation Commission's findings show that the

[14] *Ventilation: Report of the New York State Commission on Ventilation.*

symptoms caused by "bad" air disappear when the interference of such air with the regulation of body temperature is removed. Cooling, drying, or moving the air with fans corrected the conditions in the airtight room. Statistical studies which relate weather conditions with behavior show that barometric pressure has little effect, whereas temperature and humidity have considerable effect on behavior. The production of factory workers, the errors of bank clerks, the work of college students, and even the level of civilization show variations with weather conditions.[15]

THE EFFECTS OF VENTILATION ON PHYSICAL WORK

The New York Ventilation Commission's investigations showed that physical work was definitely impaired by high temperature and stagnant air. In one experiment men were required to lift a five-pound dumbbell through a distance of two and one-half feet and were motivated by a bonus. They were tested under temperatures of 68° and 75° F., with the air either fresh or stagnant. The findings are shown in Table 9.

TABLE 9. EFFECTS OF TEMPERATURE AND AIR MOVEMENT ON PHYSICAL WORK

Temperature	*Air*	*Units of Work (100 Optimum)*	*Fall in Production Due to Stagnant Air*	*Fall in Production Due to Increase in Temperature*
68°	fresh	100.0		
68°	stagnant	91.1	8 9	
75°	fresh	85.2		14 8
75°	stagnant	76.2	8.6	14.5

Production was at its highest level when the temperature was 68° and the air was fresh. Using this as a base, it will be seen that stagnant air caused production to fall off approximately 9 per cent

[15] E. Huntington, *Civilization and Climate*; also E. G. Dexter, *Weather Influences.*

under each of the two temperature conditions. It is also shown that, with the 75° temperature, production fell off nearly 15 per cent both with fresh and with stagnant air. The production under the most unfavorable conditions (warm, stagnant air) was nearly 24 per cent below production under the most favorable condition (cool, fresh air).

In another study of the problem of ventilation, in order to test the effects of air movement on production in a weaving shed during the summer months, electric fans were operated on alternate days for a period of six weeks.[16] For every hour of the eight-hour day production with the fans running exceeded production with the fans stopped. In general, the beneficial effect of the fans was greater in the afternoon than in the morning, although the third hour of the morning and the second hour of the afternoon showed the greatest increases in production.

Comparisons of the activity of miners working under varying conditions of temperature and humidity show that miners rest seven minutes per hour under the most favorable conditions, as compared with 22.4 minutes per hour under unfavorable conditions.[17] The time taken to fill a tub of coal, the number of accidents, and the time lost through sickness were also less under the more favorable conditions.

The trend of results shows that physical work is definitely influenced by atmospheric conditions which interfere with the maintenance of a constant body temperature. Ventilating systems which move and filter the air (for foreign matter) and which control the temperature and humidity should be a sound investment from the point of view of efficient management. Although research has not progressed far enough to determine specific optimum conditions, it is apparent that these conditions will vary with the type of work and with the outdoor temperature. Radical

[16] S. Wyatt, J. A. Fraser, and F. G. L. Stock, "Fan Ventilation in a Humid Weaving Shed," *Indus. Fat. Res. Bd.*, 1926, Rep. no 37, 33.

[17] For details see M. S Viteles, *Industrial Psychology*, pp. 495–497.

differences between indoor and outdoor temperature may disturb body adjustment as well as complicate the manner of dressing.

When ventilation conditions are inadequate, it is desirable that the salt lost through perspiration be replenished. Supplying workers with salt tablets would relieve some of the weakness and time losses caused by excessive perspiration in the summer. Circumstances which force men to work in drafts or near doors that are frequently opened and closed in the winter obviously should be corrected. Such conditions not only impair efficiency, but are responsible for accidents and sickness. With radical changes in temperature occurring from hour to hour, it is impossible for the worker to dress in accordance with the temperature at which he must work. If increased production can be obtained by installing modern ventilation methods, the losses in efficiency through failure to correct obvious faults must be considerable. It is difficult, therefore, to understand the frequency with which conditions of poor ventilation continue in use, even in our large industries.

THE EFFECTS OF VENTILATION ON MENTAL WORK

The experiments of the New York Ventilation Commission demonstrated that mental work may be performed as effectively under humid (80 per cent), hot (86° F.), and stagnant air conditions as under optimal conditions (circulating air at 68° F. and 50 per cent humidity). Although the subjects showed some tendency to take rest pauses more frequently under the most unfavorable conditions, the surprising fact is that mental work, even under these conditions, was affected little, if at all.

Since the statistical studies have shown some influence of weather conditions (temperature and humidity) on mental work performed outside experimental situations, the possibilities (1) that weather may affect moods, and so influence all forms of human activity, and (2) that extreme and continual unfavorable conditions may influence mental performance, must be entertained. The fact remains, however, that controlled ventilation is

more essential for physical than for mental work. The common practice of giving more attention to the comfort of brain workers than to that of factory workers is obviously inefficient. It is desirable to make employees comfortable, but the policy of denying these comforts to the physical worker and giving them to the mental worker is not in accordance with the facts and directly hampers production.

The influence of controlled ventilation on attitudes and labor turnover obviously affects all types of workers, and a favorable attitude of employees toward the management is an indirect benefit which should not be overlooked. Laboratory studies do not have to contend with this attitude factor because people who are performing under experimental conditions usually try to do their best. Since this degree of motivation is seldom present during the usual working conditions, however, production may be influenced by conditions which do not disturb the laboratory subject.

NOISE

INTRODUCTION

The disturbing effects of noise probably have been exaggerated in the public mind. The worker apparently is not as disturbed by factory noises as is the visitor, who is likely to judge the disturbance by its effect on him, without realizing the ability of the organism to make adjustments to such stimulation when it is constant. However, some discussion of the subject is required, since laboratory and factory studies are not in complete agreement and some factors may operate in the factory which are absent in the laboratory. Obviously, work which requires hearing will be influenced by a background of noise, since noise, in such cases, would be equivalent to a certain amount of deafness. In considering the effects of noise, it will be assumed that this special condition does not exist.

RESULTS OF LABORATORY INVESTIGATIONS

When loud noises are introduced in a laboratory situation, the

first effect is a startle reaction which definitely interferes with work, particularly that of a mental nature. Soon the subject adjusts, and eventually he performs better during the noisy period than during the quiet periods which precede and follow it. The improved performance is attributable to a form of adjustment and to the fact that, at first, greater effort is expended. The extra effort seems to be great enough so that the distraction is not only overcome, but work is actually improved. Even the muscles show increased tensions during noise. With continued testing, these tensions diminish, indicating that the noise becomes less disturbing from day to day and that the person has less difficulty in adjusting to it.[18]

If the overcoming of disturbance caused by noise requires effort, then it is reasonable to suppose that work in noisy surroundings would prove highly fatiguing, and that this would eventually result in lowered ability to work. Laboratory evidence fails entirely to support this view, but it is possible that the motivation is unusually high in laboratory tests, and that, during the noisy period, a person is inclined to expend a greater supply of energy. In Chapter 15 it was pointed out that production may be influenced by the energy allocated to a given task. Thus, a person asked to exert maximum effort in a test of strength will expend about 30 per cent more energy on the first trial if only one trial is required than he does if fifteen trials are required.[19] Similarly, a person may put more energy in work when the work is obviously made more difficult by noise. The person's reaction to a situation is important, since it determines the amount of energy he will be able to spend. For a long job, he unconsciously holds back; for a difficult job, he is able to summon extra energy. If he overestimates the difficulty of a noisy environment, he may have excessive energy to expend on the job. However, since the reaction of the worker to the job is closely associated with motivation,

[18] Poffenberger, *op. cit.*, pp. 133–137.
[19] Poffenberger, *op. cit.*, p. 127.

it may vary considerably from the laboratory to the factory situation.

EFFECTS OF NOISE ON JOB PERFORMANCE

A comparison of the productivity of four typists when working in a quiet office and when working in a noisy office showed no significant difference when errors, amount typed, and the number of discarded letters were considered.[20] Reports on the feelings of fatigue, taken from time to time, also showed no clear difference between the two working environments.

In an intensive investigation of the effects of reducing noise, measurements of the production of eleven weavers (women) were made when they were working with and without ear-defenders which reduced the noise of the machines about 10 per cent (from 96 to 87 decibels).[21] Comparison of the productivity of the group when ear-defenders were in use and when they were not in use (alternate weeks) showed only a one-per-cent improvement in production with their use. However, the amount of production in weaving depends partly upon the efficiency of the machinery and partly upon the skill of the worker. The mechanical operation of the loom is a constant factor, and the operations controlled entirely by the weaver occupied only five minutes in every hour. If the results are interpreted in terms of the reduction in time of the weaver's personal operations, then the improvement in efficiency amounts to 12 per cent. Occupations which involve a greater proportion of personal performance, therefore, may be expected to show a greater increase in efficiency.

The increase in production was considerably greater for weavers who reported that they were disturbed by the noise than for those who reported indifference, yet every weaver showed some improvement when using the ear-defenders. Interesting also is

[20] A. W. Kornhauser, "The Effect of Noise on Office Output," *Indus. Psychol.*, 1927, *2*, 621–622.

[21] H. C. Weston and S. Adams, "The Effects of Noise on the Performance of Weavers," *Indus. Hlth. Res. Bd*, 1932, Rep no. 65, 38–62.

the fact that the benefits of the reduced noise were more marked in the morning than in the afternoon, and that the general effect was to produce a more regular rate of output.

Although adequate details are lacking, a recent report on the effects of noise in industry shows a variety of striking improvements with noise reduction.[22] For example, the work of assembling temperature-regulators increased more than 37 per cent, and errors fell to one-eighth of their former number when the work was moved from the proximity of a boiler shop to a quiet area. Office work increased 8.8 per cent and typists' errors fell 24 per cent with a noise reduction of 14.5 per cent. The noise reduction also decreased turnover by 47 per cent, and absenteeism by 37.5 per cent. Since this report so strongly emphasizes the highly detrimental effects of noise, there is reason for believing that extreme conditions were selected.

In general, the industrial studies agree that noise reduction is associated with some increase in output. Although this increase may be questionable in some cases, it is apparent that noise does not increase production. The difference between the results of laboratory and practical investigations is probably attributable to differences in motivation. Men can do as well during noise as during quiet, but they must be highly motivated to do so. Differences between individuals, the degree and character of the noise, and the type of work are important. Sweeping generalizations cannot be made in the light of our present knowledge because of the varied nature of both laboratory and factory findings.

EFFECT ON HEALTH

Although the last-mentioned report emphasizes the effects of noise upon physiological reactions, these changes are largely confined to the startle reactions which are produced by a sudden noise. Health may be impaired if noise interferes with sleep, but more

[22] J L. McCartney, "Noise Drives Us Crazy." Reprinted by the National Noise Abatement Council, New York City, from the *Pa. Med. J.*, August, 1941.

evidence is required before we can assume that noise during work develops nervous disorders.

Undoubtedly, some individuals are hypersensitive to noise and cannot make effective adjustments. Industrial studies ordinarily would not include highly sensitive individuals, since these would have left for other positions. The facts that noises will bring on fits in some epileptics and that some strains of rats and mice can be induced to have violent convulsions by being exposed to such noises as the jingling of keys suggest that there are distinct hereditary factors which make noises irritating and intolerable to some individuals. Sudden and loud noises produce fright reactions in all persons, and loud and persistent noises (particularly those of high pitch) may produce deafness to certain pitches. Such noises should obviously be eliminated if possible, or reduced with ear-plugs when this cannot be done.

EFFECT ON MORALE

In so far as factory or office noise is of such character that it is generally unpleasant, it may be assumed that its correction will lead to better morale for the same reason that any consideration for the welfare of employees tends to produce a favorable reaction. Extreme quiet, however, also may be disturbing and too much attention to noise reduction may be undesirable. In a quiet background, even the slightest noise may stand out and be more disturbing and disruptive than the general effect of a constant background of noise. Until more accurate information is obtained, it is well to place considerable reliance upon the opinions of workers as to whether or not they desire sound-proofing and other corrections. In case of wide disagreement, ear-defenders may serve the purpose.

The fact that noises are generally unpleasant may be a factor in social reactions and relations, even when they do not markedly influence individual performers.[23] Noises which are intermittent

[23] K. G. Pollock, and F C Bartlett, "Psychological Experiments on the Effects of Noise," *Indus Hlth. Res. Bd.*, 1932, Rep no 65, 1–37.

are certainly the most disturbing as far as emotional reactions are concerned, while noises which are meaningful (conversational) are the most distracting. In a highly motivated situation, these can be overcome by extra effort, but the necessity of overcoming them may create a source of irritation between individuals, particularly if an individual is the source of the noise.

OTHER ENVIRONMENTAL FACTORS

Workers are most loyal and co-operative when they have pride in their work and in their employer. Management's striving to overcome grievances in the job environment is one way of building up this pride. Clean and adequate toilet and washroom facilities, although insisted upon by women, also influence men. The argument that employees do not keep them clean is an admission of poor morale and an unfavorable attitude. Company restaurants which are clean, quiet, and comfortable are conducive to a pleasant social atmosphere, which every worker appreciates. These factors must be considered also from the point of view of sanitation and health, conditions for which management must certainly assume responsibility.

Attractive physical appearance of the plant is conducive to pleasantness; it also causes employees to feel that the company considers them important enough to deserve such an environment. They likewise have more pride in their jobs if they can come to work clean and well dressed and leave in a similar condition. The installation of showers would make this entirely possible; and the more heavy and dirty the work, the more the showers would be appreciated. Even recreational facilities would give desirable returns in the form of employee pride in their jobs. A management which is sensitive to the welfare of its employees can depend upon good morale, which we found so highly important in the earlier chapters, as well as upon a waiting list of potential employees from which it can choose the most desirable workers.

18 PSYCHOLOGICAL FACTORS IN LABOR TURNOVER

BASIC CONSIDERATIONS

COST OF LABOR TURNOVER

Separations of employer and employee come about for a large number of reasons. Some of these are inevitable; others may be avoided. A knowledge of the basic factors in avoidable labor turnover may lead to a reduction in the rate of turnover and create a saving in hiring and training costs. These savings may be more considerable than they first appear. Replacing an employee who has been in service for many years may require the hiring and training of several men before a relatively permanent employee is again found. In addition, new employees are more subject to accidents, cause more breakage, and make more errors than experienced workers, so that costs of replacing a man may exceed the estimates, which range from thirty to three hundred dollars, depending on the job.

Another important aspect of turnover is the fact that it reflects conditions in the plant. A company that has high labor turnover is regarded unfavorably by employees and by society. By analyzing the reasons for turnover, we can determine some of the faulty practices that are more prevalent in one company than in another. Before judging a company, however, we must take into account the nature of the causes of separation.

TYPES OF CAUSES OF LABOR TURNOVER

Unavoidable forms of turnover are constant factors and in-

fluence all forms of work, as well as all companies. Death, permanent disability, retirement, marriage, and change of residence create labor turnover which falls into this category.

Turnover caused by lay-offs and seasonal conditions may depend upon factors beyond the employer's control, but he can influence these to a considerable degree. By careful planning of work, it is possible to approach a uniform production schedule so that a permanent staff is employed throughout the year. If employers were required to hire on an annual basis, much of this planning would be made. The problem of seasonal fluctuations in the demands of a product can in many cases be solved (1) by storing products which are non-perishable (coal, for example), (2) by combining the manufacture of two types of seasonal products (ice and coal, candy and ice cream, straw and felt hats), and (3) by introducing incentives which influence the demand (time of change in car models, reduced prices, and so on). In other cases, part-time employment of married women, college students, and the like, may be arranged to make up for extra employee demands. Such individuals may be semi-permanently employed during rush periods without disturbing the balance of the labor market. Efforts to maintain a permanent staff reduce hiring and training costs and promote the formation of a more faithful and conscientious working force.

The number of discharges which are required because the employee is ineffective can be reduced by more careful selection and by shifting men into work for which they may be better fitted. A low rate of discharge does not mean that the employment methods are satisfactory, however. A company that is not discriminating and does not measure individual productivity may have a low discharge rate because of inefficiency in its production-measurement program.

Resignations which are made because employees prefer to work elsewhere are the most revealing. Quitting a job is an individual employee's method of attaining retaliation; actually, it is a form

of aggression. The same factors which give rise to an excessive number of separations of this sort may also be the cause of strikes and restricted production. When the employee has no opportunity for re-employment elsewhere, he uses methods other than resignation for expressing dissatisfaction. Other reasons for quitting also occur, however. Misfits wander from job to job, until by trial and error they eventually may find satisfactory employment. In these cases vocational selection seems to be the ultimate solution. Other individuals are chronic quitters, and it would be desirable if selection methods could detect them. Their previous record of instability would be one index of this tendency.

In determining the kind of individuals who voluntarily leave their employment, it is important to distinguish between the resignation of satisfactory and unsatisfactory employees. If those who quit are inferior in workmanship, the separation may actually be desirable; but if the resignations are predominantly among the more satisfactory employees, then the condition is serious. When employees leave their jobs, a selective factor may be operating which either raises or lowers the standard of the permanent working force.

MEASUREMENT OF LABOR TURNOVER

The rate of labor turnover (T) is usually expressed as the ratio between the number of separations (S) and the average labor force (F) for a given period of time, the formula being

$$T = \frac{S}{F}.$$

By multiplying the fraction by 100, the turnover can be expressed as a percentage. This treatment of turnover data does not distinguish between the various forms of turnover. When a working force is being reduced, a large number of lay-offs occur; if this factor is to be eliminated from the turnover data, the number of

replacements (R) is substituted for the number of separations (S) in the formula, so that it reads:

$$T = \frac{R}{F}.$$

Sometimes it is desirable to eliminate unavoidable separations from the turnover rate. In such a case the numerator expresses only the avoidable turnover

$$T = \frac{R - U}{F}.$$

These and other variations in the formula tend to reduce the magnitude of the turnover rate. It is important, therefore, that the methods of calculating turnover be considered when making comparisons between companies. If unavoidable turnover operates to the same degree in all companies, the first formula is a sufficiently accurate procedure to follow, since differences in the rate will usually be caused primarily by differences in avoidable turnover.

The particular interest of the psychologist is to determine the objective and subjective conditions which create high labor turnover and to discover whether or not separations are lowering the quality of the permanent working force. Since different individuals react to different factors in the job situation, it is important for efficient management to determine the particular factors which influence the resignations of the most desirable employees.

SPECIFIC FACTORS RELATED TO LABOR TURNOVER

LENGTH OF SERVICE

An analysis of turnover in terms of length of service is very revealing, since it shows that, even when turnover is high, a large proportion of the employees are stable, whereas a minority is constantly fluctuating so that the same positions must be filled re-

peatedly. Analysis of the labor turnover of a public service corporation, for instance, showed that for six different departments the annual turnover ranged from 66 to 339 per cent. The average for all departments was 187 per cent, showing that, on the average, nearly two men were hired for each job within a year.[1]

When the data were analyzed in terms of length of service, it was found that, among employees who were in the service for less than a month, the turnover rate was 1026 per cent; while among employees in service from one to three months, the rate dropped to 226 per cent. This drop in turnover shows that, when an employee remained with the company for as long as a month or more, he was one-fourth as likely to leave as a newly hired employee. In this particular company, turnover continued to decline with longer service so that, by the time employees were in the service for two years or more, the turnover rate was only 11 per cent. The analysis also shows that 80 per cent of the persons leaving the job had served less than three months and that one-half of the staff had served more than one year.

The relation between turnover and length of service constitutes a strong argument for seniority rewards. In order to replace a man who has been in service for a year, there is a strong probability that more than ten men will have to be hired to obtain another year's service. Data of this sort show also that there is a moving labor supply which is responsible for most of the expense of hiring and training. Some of this unstable labor supply is undoubtedly unemployable, but another part is moving about from job to job trying to find work which suits the interest and ability of the individual. Vocational guidance in public schools would do much to orient some of the individuals responsible for this fluctuation, while proper selection methods would eliminate a good deal of the hiring of misfits.

[1] W. D. Scott and R. C. Clothier, *Personnel Management*, pp. 469–472.

AGE

If part of the unstable labor supply is due to trial-and-error job-seeking, one would expect young men to show higher labor turnover than older men. This point is supported by an analysis of labor turnover in relation to age. In a study of common laborers, it was found that for persons between the ages of seventeen and twenty-three years the average length of service was around seven weeks, whereas for those whose ages were between thirty and thirty-five years the average length of service was about three times as great.[2]

Although the desire to find satisfactory employment is undoubtedly one of the factors in high turnover among youths, other factors must also be considered. The youth is more reckless, and, because he has fewer responsibilities, he can express his dissatisfaction with a job by quitting it.

The importance of responsibility in preventing turnover is shown by the fact that labor turnover again increases among workers who are more than thirty-five years of age and reaches another high point at about forty-two years. At this age the average length of service is about half as great as among the thirty-to-thirty-five-year age group. This new high point in turnover comes at an age when family responsibilities begin to decline because the children have reached an age when they can work. The dissatisfied laborer seems to take this opportunity of reduced responsibility to better his condition.

After workers reach the age of forty-five years, the length of service increases rapidly, so that, by the time the age of fifty-two years is reached, the average length of service for common laborers was found to be thirty-three weeks. At this age it is difficult for men to obtain new employment, so they must remain with the old job, whether they like it or not.

[2] W. D Scott, R C Clothier, S B. Mathewson, and W. R. Spriegel, *Personnel Management*, p. 504

MARITAL STATUS

Although the proportion of married men increases with age, a separate analysis of the data in terms of marital status shows that it is one of the factors which influences the age trend in turnover rate. Among common laborers the average length of service for married men was found to be about three times as great as that for single men. It is probable that marriages make for both stability and responsibility, factors which reduce turnover rate under normal conditions of employment.

INTELLIGENCE AND LABOR TURNOVER

INTELLIGENCE AND VOCATIONAL ADJUSTMENT

Intelligence may be expected to influence dissatisfaction, and hence labor turnover, in two ways. In the first place, a job which is too difficult will be a constant strain for the individual with insufficient intelligence. He frequently is reprimanded for inferior work, tends to worry over responsibility, and feels insecure. As a consequence, he will likely quit, if he is not discharged. In the second place, since the person of superior intelligence may find many occupations boring, he may leave his job to seek occupations which are more challenging and diversified. If this analysis is correct, one may expect turnover to show a varying relation with intelligence in different occupations. Likewise, one may expect intelligence and turnover to show different relationships among men and women, since it is customary to promote men to responsible and complex positions more readily than women.

TURNOVER AMONG MEN AND WOMEN

A study of the relationship between mental alertness and turnover in two similar companies, one employing men clerks and the other women clerks, showed a deviation in trend which was obviously caused by the sex difference in personnel.[3] The company

[3] Scott and Clothier, *op cit*, pp 463–466.

employing women had the lowest turnover among women making an average score on the mental test, whereas women making either low scores or high scores on the test tended to leave. In the company employing men, the turnover was also high for low-scoring men, and, as in the case of women, the turnover dropped as the scores approached the average. Among men with alertness scores slightly above average, there was a tendency for the turnover to rise, but, instead of continuing to rise with further increases in scores, it dropped sharply, so that the lowest turnover was present among men with the highest mental alertness scores. The curves showing the relationship between turnover and mental alertness in the two sexes are shown in Figure 20.

It is apparent that men clerks with high mental alertness scores were being induced to remain, whereas this inducement was not present to the same degree in the case of the women. The high turnover among low-scoring individuals was not disturbing, since these individuals were the least proficient. However, since the high-scoring individuals were the most efficient employees, it was important that these remain with the company. Among the men the promotion system apparently took care of the superior individuals, inducing them to stay. The fact that the superior women did not remain demonstrates the necessity of developing a better promotion system among women employees. Companies which discriminate against women can expect superior women to be dissatisfied and to leave for companies which show a lesser degree of discrimination.

In general, there is a tendency to promote intelligent individuals more rapidly than less-intelligent ones, but this relationship is more marked for men than for women. In one company the correlation between intelligence and rate of promotion was .58 for men and only .39 for women. In another company 18 per cent of the men who were below average in intelligence were promoted, whereas only 2 per cent of the women who were below average were promoted. Among employees of superior intelligence, 39

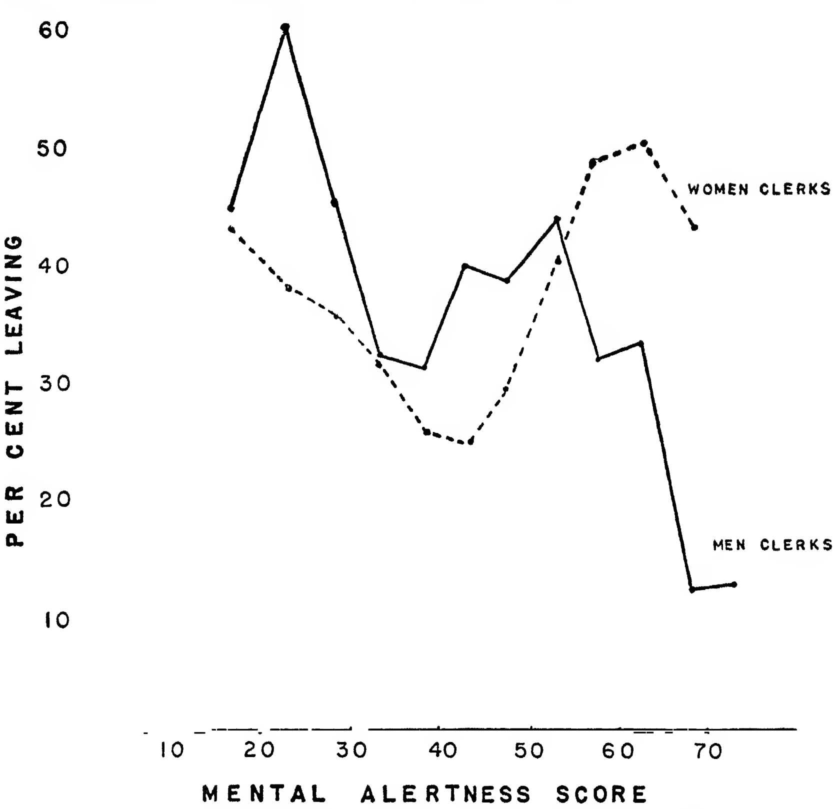

Figure 20. Labor Turnover Among Men and Women Clerks in Relation to Intelligence

The two curves are similar for low-scoring and average individuals, but, among superior individuals, the turnover trend is very different. Superior men show little inclination to leave, whereas superior women are among the most likely to leave. Inadequate promotion of women is responsible for this difference in turnover. (After Scott and Clothier, op. cit.)

per cent of the men were promoted to responsible positions, as compared with 17 per cent of the women.[4] Although intelligence influenced the promotions of both men and women, men of inferior intelligence had as good a chance for being promoted as women of superior intelligence.

[4] M. Pond, and M. A. Bills, "Intelligence and Clerical Jobs: Two Studies of the Relation of Test Score to Job Held," *Person. J.*, 1933, *12*, 41–56.

Since superior intelligence is required for responsible positions, it is important that mentally superior individuals are not lost in the turnover process. In order to keep them until they are ready for promotion, it is necessary to favor them by pay raises and the promise of prompt promotions when they can qualify. Intelligent men and women desire complex and responsible assignments; these assignments, in turn, require intelligent individuals.

TURNOVER IN DIFFERENT DEPARTMENTS OF A FACTORY

In relating intelligence and turnover, it is important to differentiate between the various types of work. In one study intelligence scores were not available, but the age at which each employee quit school and the grade he had attained were known. From these data, it was possible to determine which employees were retarded in school, and this served as a rough estimate of intelligence. It was found that the school records of the employees showed differences which ranged from seven years retarded to two years advanced, the average being about two years retarded. To obtain evidence of dissatisfaction, the employees were asked whether or not they desired a change in work. This expression of dissatisfaction with the job may be regarded as a measure of potential turnover.

When the percentage of individuals desiring a change was plotted against the extent of retardation in school, the total of seven departments (470 men) yielded a curve which showed a decrease in job satisfaction as intelligence (in terms of school success) increased.[5] Only 30 per cent of those retarded seven years desired a change. This percentage of dissatisfaction rose gradually until the group which was retarded two years was reached. With this degree of retardation, 65 per cent were dissatisfied. Further increases in intelligence up to two years advanced in school showed no further change.

Analysis of the results in terms of various departments clearly

[5] Scott and Clothier, *op. cit*, pp 466–469.

showed that this trend of dissatisfaction in relation to intelligence was entirely misleading. The analysis of seven different departments showed four distinctly different relationships. In the assembly department, dissatisfaction declined with increased intelligence, whereas in the inspection department the trend was just the opposite, with dissatisfaction increasing with intelligence. Interesting also is the fact that the inspection department had a lower proportion of superior individuals than did the assembly department, showing that some dissatisfaction had already expressed itself in turnover.

The tool and foundry departments also showed opposite trends. In the tool department, the employees of average mental ability (about two years' retardation) were the most inclined to be satisfied, while in the foundry department this group of employees was the least inclined to be satisfied. The results obtained for the gear and lathe departments were similar to those of the foundry department. Thus, within seven departments of a factory, there were jobs which were most satisfactory for each level of intelligence. It is clear that shifting individuals within the plant in accordance with the findings would make possible a great increase in job satisfaction.

Analysis of the jobs in the various departments showed that the complexity and variability in work were highly different. In the assembly department, the worker had an opportunity to express a degree of creative ability and skill which was beyond the talents of retarded persons. In the inspection department, on the other hand, the work was routine, repetitive, and "foolproof," the sort of activity best suited to retarded individuals.

The tool department permitted independent decisions and the work was varied. It was sufficiently difficult to make retarded individuals uncomfortable, but was not difficult enough for men above average intelligence. On the other hand, work in the foundry and the gear and lathe departments satisfied the average individuals the least, but instead satisfied both the highly re-

tarded and the advanced in intelligence. This apparently contradictory condition is readily explained by the fact that these departments had two distinct levels of work, making it possible for the two extreme groups of workers to be satisfied for different reasons. The low-grade work in these departments satisfied the mentally inferior, while the high-grade work was performed by the more superior individuals. The men of average mental ability were dissatisfied because they did not like the low-grade work and were unable to compete with the more superior men for the high-grade work.

Whenever individuals of widely separated levels of intelligence behave similarly and those having a degree of intelligence between the two extremes behave differently from them with respect to job satisfaction, it may be assumed that the similar behavior of the extreme groups is attributable to very different causes. It is apparent that the concept of maximum and minimum scores will be very useful in finding the levels of intelligence which are best suited to specific kinds of work, even within the same department. This means that turnover analyses should be made not only according to departments, but according to types of work as well. In Chapter 13 we pointed out that intelligent men in a police department were dissatisfied with being patrolmen, but that they would have been satisfied with more responsible and complex assignments. Because all individuals were treated alike in the promotion schedule, the most intelligent policemen tended to resign from the service, leaving the less intelligent men eligible for promotion. In general, the evidence clearly shows that the practice of requiring men to work up gradually through the ranks creates a great deal of job dissatisfaction. Training methods which rapidly prepare capable men for more responsible positions would do much to encourage the superior individuals and yet would permit them to become familiar with the whole plant. In other cases such familiarity with the general plant routine is unnecessary, and selection should be made from indi-

viduals who are intellectually qualified. Experience on the lower-grade jobs does not develop intelligence; for this reason promotions based on experience must be made with discretion.

RELATION BETWEEN TURNOVER AND JOB COMPLEXITY

Since the relationship between intelligence and turnover varies for different jobs, one may expect job complexity to be the important factor in causing people of low and high intelligence to show different degrees of dissatisfaction for the same job. This point has been clearly verified by a study made on clerical workers.[6] Tests of mental alertness were given to employees at the time of hiring. The jobs were classified into five categories according to their level of difficulty; *A* jobs being the least difficult, and *E* jobs the most difficult. In analyzing the data, the average-scoring individuals were eliminated so that comparisons between the two extreme groups could be made. The extreme groups used were those with mental-alertness scores below 80 (inferior group) and those with mental-alertness scores above 100 (superior group).

The first part of Table 10 shows the results for the individuals who were superior in intelligence. It will be seen that, in originally placing the individuals, there was a tendency to assign a greater proportion of them to the more complex jobs. Nevertheless, thirty months later the proportion of these individuals in complex jobs increased (because of the high turnover of low-scoring individuals), whereas the proportion of these individuals in simple jobs decreased (because of their own high turnover).

The second part of the table shows the results for the individuals of inferior intelligence. It will be seen that an opposite trend in personnel shift occurred in this group. After thirty months, the complex jobs had a lower proportion of low-scoring individuals, whereas simple jobs showed no such losses.

A study of the last column shows that turnover among superior

[6] M. A. Bills, "Relation of Mental Alertness Test Score to Positions and Permanency in Company," *J. Appl. Psychol.*, 1923, *7*, 154–156.

TABLE 10. RELATION BETWEEN INTELLIGENCE AND JOB COMPLEXITY

(From Bills, *op. cit.*)

Grade of Work	Original Group	30 months Later	Percentage of Turnover
	Percentage Scoring 100 or Better		
A (most simple)	26	0	100
B	20	0	100
C	45	27	72
D	46	51	53
E (most difficult)	50	57	41
	Percentage Scoring under 80		
A	50	57	37
B	53	50	62
C	53	36	50
D	30	23	58
E	13	7	66

individuals declines as job complexity increases, demonstrating that a basic cause in turnover among these individuals is dissatisfaction with work that is too easy for them. Intelligent individuals tend to become satiated with tasks they can learn too readily, for, once they have learned them, they can experience no further progress. (For a discussion of satiation, see pages 312–322.) Among individuals who are below average in mental alertness, turnover, in general, increases with job complexity, showing that these individuals are dissatisfied with work which is too difficult for them. Thus, intelligent and unintelligent individuals are dissatisfied with their jobs for quite different reasons, and a determining factor in this difference in behavior is the complexity of the job.

This study demonstrates also that turnover functions as a selective process which allows the individuals who remain to

be more suited to their work. The superior individuals tend to accumulate in difficult jobs; the inferior ones, in simple jobs. Turnover thus operates to produce vocational differences in intelligence. The careful placing of applicants on jobs which are suited to their levels of mental capacity would greatly reduce this form of labor turnover.

That scores on motor and personality tests would show similar relationships with turnover is indicated by the fact that there are occupational differences in some of the traits which these tests measure. Apparently, turnover also operates in these cases to achieve select groups of individuals. Analysis of turnover with reference to other human traits might reveal significant tests which could be used to place employees in jobs which suit their mentality, personality, and motor equipment. Reduced labor turnover may therefore be considered a by-product of scientific selection methods.

LABOR POLICY AND TURNOVER

WAGES

Since it is obvious that high wages will compensate for some grievances, this factor alone will influence turnover. How it will affect the quality of the working staff, if no other factors are operating to influence the selection of employees, is not so apparent and requires some analysis of data.

On January 1, 1914, the Ford factory reduced hours from nine to eight per day, and at the same time increased the minimum daily wage to five dollars. At the time this was a radical change in labor policy and the plan was widely publicized. Table 11 shows the effect of the change in policy on labor turnover.[7] It will be seen that the change in the wage scale, with the accompanying publicity, reduced the resignations, lay-offs, and discharges so that within a two-year period the total turnover dropped from 370 per cent to 16 per cent. Most interesting is

[7] Scott and Clothier, *op. cit.*, p. 452.

TABLE 11. EFFECTS OF INCREASED WAGES AND REDUCTION OF HOURS ON LABOR TURNOVER

(From Scott and Clothier, p 452)

Year	*Average Force*	*Resignations*	*Discharges*	*Lay-offs*	*Total Leaving*	*Percentage of Turnover*	*Ratio of Resignations to Discharges*
1913	13,623	39,575	8,490	2,383	50,448	370	4 7
1914	12,115	5,199	924	385	6,508	54	5 6
1915	18,028	2,871	27	23	2,921	16	106.3

the fact that the rate of discharges fell more rapidly than the resignations. The last column of the table shows the ratio between these two types of turnover. In 1913, there were 4.7 times as many resignations as discharges. After one year this ratio rose to 5.6, and during the following year there were 106.3 times as many resignations as discharges. This decline in the relative number of discharges means either that the company became less exacting in its standard of work or that the qualities of the employees had greatly improved. As the general turnover rate had become very low, there is every reason to believe that the company would become more, rather than less, discriminating. In such case the most plausible conclusion is that the workmanship had greatly improved. The fact that the marked change in ratio occurred after the second year supports this interpretation, since it would take some time for this selection process to be accomplished. Immediately after the change in policy, the ratio between resignations and discharges was almost the same as before, but, because of the immediate drop in turnover, it is reasonable to suppose that satisfactory employees were remaining in the company. By the end of the year the unsatisfactory employees had been pretty well eliminated by discharges; after that,

with a higher caliber of applicants from which to choose, further discharges became almost unnecessary.

The reputation gained by this labor policy paid large dividends. In many parts of the world, the Ford Company is still known because of it. The figures clearly show a form of advantage that can be gained by an action which gives a company a favorable reputation. The long waiting list and productivity of the Jack and Heintz plant is a more modern illustration of the dividends paid by a favorable reputation. When a company employing a labor force of six thousand employees has a waiting list of thirty-four thousand, at a time when a labor shortage exists, it is apparent that a superior staff can readily be acquired.[8]

MORALE

Although dissatisfaction with the job is an important factor in influencing labor turnover, dissatisfaction with the employer is perhaps even more important. Companies employing similar types of labor show striking differences in their turnover rates, despite similarities in wage scales. A company that offers security, retirement allowances, and insurance benefits achieves a great reduction in its labor turnover. Improvements in the working environment, consideration for the health and welfare of the employee, and policies which respect the dignity of human beings, all tend to produce a favorable attitude toward the company. Even if all employees do not respond to favorable working conditions, such conditions do appeal to the most responsible and the most desirable employees. A well-known physician and his wife wrote a book entitled *Babies Are Human Beings* because they felt that parents had to have the fact which is stated in the title pointed out to them.[9] When dealing with the average employer, it seems necessary for the psychologist to point out to him that

[8] R. Coughlan, "Jack and Heintz," *Life Magazine*, 1943, *14*, 74–81; also J. A. Kouwenhoven, "Jack and Heintz — Factory or Free-for-All," *Harper's Magazine*, 1943, *186*, 556–564.

[9] C. A. Aldrich and Mary Aldrich, *Babies Are Human Beings.*

workers are human beings. Any condition which is conducive to better human relations and which improves morale will invariably reduce turnover as well as other forms of the workingman's expression of disapproval of his employer. A company which strives to reduce its turnover will automatically reduce these other expressions of dissatisfaction, the result being increased production. In the earlier chapters it was shown how attitude and morale affect an employee's productivity. We may now add that these factors also operate to select the individuals who are employed.

THE IMPORTANCE OF LABOR-TURNOVER ANALYSIS

Since turnover is an expression of dissatisfaction, its analysis may be used as a method of determining the nature of employee needs and desires. One cannot assume that certain policies are good for employees just because the employer thinks they are. This attitude among some employers almost makes them benevolent dictators. In order to follow the democratic methods of leadership, it is important to satisfy the needs that exist in a given working population, rather than to offer incentives which satisfy hypothetical needs, or needs which employers believe should exist. Turnover analysis exposes the nature of the existing needs of various groups of employees, even when the employees are unconscious of their nature and are unable to verbalize them.

By having employees vote on whether or not they are satisfied with their jobs, it is possible to detect the presence of potential turnover. This method may be considered a delicate instrument for detecting the same conditions of dissatisfaction as those which become apparent through an analysis of voluntary turnover. In using the more delicate procedure, the employer may correct conditions before they lead to resignations, strikes, restrictions in production, petty thievery, and other expressions of disloyalty and aggression.

A diagnosis of an illness in labor relations before the condition becomes serious is as important to the employer as is an early diagnosis of disease to the physician. Methods which aid in making a prompt diagnosis should be practiced and further developed by scientific managers.

It is sometimes assumed that too much interest in the employee's welfare will lead to unreasonable demands on his part, and that soon the employer will have no rights at all. This argument is likely to be set forth by the individual who believes that "sparing the rod spoils the child." No child has been helped by the rod; moreover, modern educational methods achieve more by positive motivation. It is likewise true that a child is not spoiled by the fact that his parents are interested in his welfare. Rather, the *problem* child is created in the home which fails to show a vital interest in his well-being. The secure and happy child wishes to co-operate with his parents and to please them. He acquires their social attitude and grows with the trust and responsibility that his parents place in him. With the proper kind of consideration, he does not demand that which his parents cannot give him. This trend in the development of social values is characteristic of human nature; and workers, like the child and the employer, are human beings.

19 CONCLUSIONS

After considering the various psychological problems specifically, it is well to examine them again from the point of view of the persons in industry who must meet these problems. We shall, therefore, consider the various problems as they affect the supervisor, the counselor, and the higher levels of management.

THE FIRST-LINE SUPERVISOR

Since the first-line supervisor is usually in closer contact with a larger number of people than any other supervisor, he can perhaps make a greater number of applications of psychology than any other person in an organization. Even though his area of freedom is limited by company policies and practices, as well as by his own supervisor, he still is free to apply what he learns to many of his daily problems. Since the limitations to his authority vary greatly from one company to another, the applications considered below must be regarded in the light of these restrictions.

TYPE OF LEADERSHIP

Every supervisor can increase the degree to which he permits employee participation. If he has been giving orders autocratically, he can move toward democratic leadership by explaining reasons, by showing how the orders he gives fit into the picture as a whole, and by listening to the opinions of the men. He encourages participation by letting employees in on the "why"

of the orders. Better still, he may place the problem before the employees and permit them to contribute to its solution.

The author, in training supervisors both in war training classes and in particular industries, has found that sharing a problem with employees invariably increases co-operation. For example, one supervisor with whom he came in contact permitted employees to decide how many errors were reasonable on a given job. He found that the employees discussed the issue intelligently. The supervisor not only learned about the employees' problems and attitudes, but found that they set a goal which exceeded the former standard. Although he was sure the goal set was over-ambitious, nevertheless, it was attained, and the interest in watching the record greatly increased job satisfaction.

Another supervisor asked employees to decide how an annual repetitive job should be handled. Previously, it had been the custom to take two men off their regular jobs for a week and have them do it. Invariably, the two men who were affected complained. The group decided that each workman should be given a share of the job, and, when he had finished his part, he would be through. No one would be called upon to help another who was behind. A date for completion of the job was also set. The result was that the extra work was completed by the date set, and in a shorter time than any comparable group in the company had completed it. Further, it was the first time that the extra job had been done without bickering and friction.

A third supervisor greatly improved accident records by putting the problem of accidents up to the men. Previously, all the initiative in accident prevention had been assumed by the foreman.

These illustrations show that, with a little training, supervisors can utilize procedures of democratic leadership and that the method is applicable to a variety of jobs. In each of these cases, the supervisor used his ingenuity in finding a place to try out the method.

Democratic methods are not limited to the handling of specific jobs, but are also reflected in daily contacts. The democratic supervisor respects the dignity of each individual. His bossy or paternalistic attitude decreases and his attitude becomes that of a man among men. In developing this attitude, he is aided by instructions which increase his knowledge of human nature.

ATTITUDES AND MORALE

Once the supervisor fully appreciates the fact that attitudes and morale are caused, he takes a less belligerent attitude toward those attitudes which he finds disruptive. He appreciates his own part in the development of unfavorable employee attitudes, seeks to determine their causes, and encourages the free expression of opinions. He does not pass judgment on his employees because of the way they feel about things, but strives to learn about their attitudes and accepts the ones he finds as facts.

As a consequence, the supervisor learns about sources of dissatisfaction before they reach a troublesome stage. Many of these he himself can correct. In other cases he may seek the co-operation and aid of management. He appreciates the fact that unfavorable attitudes may reflect poor adjustment and that the mere opportunity to express attitudes is a form of relief. He may even suggest to a poorly adjusted employee that the company counselor might be able to help him with his problems.

A recognition of the importance of employee attitudes will make the autocratic type of leader more fair, since he will be influenced by what employees regard as fair. To a degree, he will be moving in the direction of the democratic type of leadership.

He may recognize the values inherent in fairness, friendliness in giving orders, and reasonable discipline, even though he does not extend participation. Many of the other conditions conducive to good morale (pages 84–89) can also be instituted without changing the basic form of leadership control. However, it will be apparent that the democratic method most readily incorporates

the essential principles which we have discussed. Even enlightened autocracy, although preferable to strict autocracy, does not develop initiative, since it is likely to be paternalistic. Initiative grows with the experience of participation.

FRUSTRATION

A knowledge of frustration helps the supervisor to recognize poorly adjusted employees. He then has the opportunity to arrange for special attention for such individuals either from himself or from a company counselor. He understands that it is pointless to blame such individuals for their behavior or to become angry with them. He likewise will be sure, when frustration symptoms appear in a large number of employees, that he is not dealing with maladjusted individuals, but rather with average individuals working under abnormally stressful conditions. Thus, if a large number of employees hate the company, he may be quite confident that company practices need improvement. If he has a greater proportion of poorly adjusted employees than do other supervisors, he will recognize the fact that he himself is a source of frustration.

It is important that the supervisor recognize symptoms of good adjustment as well as the situations which are conducive to such adjustment. If unfavorable situations arise, he must realize that all individuals will not make similar adjustments, since some persons can take reverses better than others. He must expect and respect such differences in people.

If the supervisor considers himself a leader, he must appreciate the fact that it is more his responsibility to understand his men than it is theirs to understand him. The supervisor who demands that employees adjust themselves to his moods and mannerisms is demanding more than he will receive. Good supervisors should be chosen for their ability to handle people; if they expect handling, they are asking employees to make up for their own failings.

INDIVIDUAL DIFFERENCES AND HUMAN ABILITY

If he has no knowledge of the great range of human ability, the supervisor is likely to expect equal amounts of work from all employees. He expects too much from the less capable ones, and fails to encourage the most superior ones. Instead of using the average as a standard, he holds up the superior workman as a model and belittles the less capable. He thus may have a very prejudiced notion of a reasonable day's work.

When he knows the many specialized abilities that different people possess, he is in a better position to recommend transfers and is less inclined to assume that inability to do one job disqualifies an employee for other jobs. Often a man's inability to do a job is interpreted as unwillingness to do it. A good foreman recognizes that unsatisfactory work may be attributable to a variety of causes.

Below are a number of formulas which may aid a supervisor in tracing the causes of poor performance. Although they are greatly simplified, they are sufficiently accurate for most purposes.

1. Aptitude = unpracticed or natural ability or talent for a particular kind of work.
2. Aptitude × training = achievement, or ability to do a given job.
3. Achievement × motivation = production, or the actual work accomplished.
4. Production × attitude = merit, or a man's total value on the job.

TRAINING

Some knowledge of motion and time study will aid a supervisor to appreciate the importance of the method of work. He will appreciate his part in seeing that a man is properly trained at the outset. Sometimes poor performance is caused by poor methods

rather than by lack of ability. Some knowledge of how men learn skills will also be of aid to him in his teaching of a job.

Often, training of employees and job analysis fall outside the duties of the foreman. Nevertheless, trainers and motion and time experts work in close contact with the foreman. An understanding of the problems will aid the foreman in his co-operation with the experts. Frequently, it will place him in a position where he can make good suggestions. Certainly, it is his duty to inform trainers and motion-and-time-study experts of any undesirable attitudes their activities may arouse.

MOTIVATION

The subject of motivation deals with the *will* to work. It is the source of a great deal of variation in human behavior. Too often, we assume that all people are different and must be treated individually. When we learn the kinds of choices people have to make and the kinds of interests they have, we find that their behaviors are alike in principle, even though their choices are different. A foreman who understands the motives behind a man's actions will find that an employee's behavior makes sense when viewed in terms of his motives.

A foreman who makes it a point to learn about the aspirations of his men will better understand why some refuse promotions, while others desire them, even though they may be incapable of doing the job to which they aspire. When he discusses promotions with the men, he will see to it that he encourages rather than interferes with their levels of aspiration. Often, when a promotion is denied him, a person becomes embittered, and, as a consequence of his negative attitude, subsequent promotions are likewise denied him. Since he may lose this bitterness if the desired promotion is given later, it is unfortunate if the poor attitude is the sole reason for denying the later promotion.

The whole problem of discipline is associated with motivation and the injurious effects of reprimand become clear when con-

sidered in relation to a man's ego. A foreman should know the value of praise, competition, and group spirit, since he is in close contact with the job and the social structure in which it is embedded.

The fear that praise will overinflate a man's ego has no support from psychology. Likewise, psychologists discourage the practice of making a man admit his mistakes. It is better to give a man an "out." Help him "save his face" and encourage his pride.

In brief, motivation deals with the problem of making a person do a good job and co-operate because he wants to rather than because he is afraid not to.

FATIGUE AND BOREDOM

The supervisor's interest in fatigue and boredom is primarily based upon his desire to obtain a better understanding of men and their complaints. It makes quite a difference in a supervisor's conduct whether he experiences a man's stoppage of work as a rest pause or as loafing. Often, he accuses a man of loafing without first learning how much the man actually accomplishes in a day. Sometimes records show that the so-called loafer has superior production. When the supervisor understands the effects of the rest pause on fatigue and boredom reduction, and its value as a sub-goal, he will be a better judge of employee work patterns. Frequently, he is in a position to recommend standardized rest pauses; usually, he is in a position in which he must interpret unauthorized pauses.

Morale and boredom have a great influence on each other; since the foreman can influence the former, he can also reduce the latter by his method of handling people. He may also find ways in which he can apply some of the principles which we have discussed to his particular group of employees.

The psychological effects of interruption on behavior are recognized immediately by supervisors, and they invariably find ways in which they can profit in their dealings with men by avoiding

unnecessary interferences. Since the desire to complete a task is so strong, it should be harnessed and used to reduce boredom.

ACCIDENTS

The facts having to do with accidents have value for the foreman in that they dispel his tendency to regard them purely as a matter of recklessness. When he realizes that accidents are caused by a great variety of conditions, he can take a constructive approach both in dealing with his men and in making recommendations to management.

TURNOVER

Every supervisor should know that a factor in low turnover is job satisfaction. He can influence job satisfaction by the way he treats his men and by the kind of social atmosphere he maintains in his department. Job satisfaction also depends upon the degree to which a man's abilities and interests are suited to his job. When he recognizes these factors, the supervisor can often arrange transfers before dissatisfied employees reach the point of quitting. It likewise is well for him to know that many of the same factors which lead to turnover also cause tardiness and absenteeism. These behavior problems are often symptoms of a low degree of job satisfaction and suggest that an interview with the employee may be very revealing.

THE COUNSELOR

TYPE OF LEADERSHIP

The counselor is primarily concerned with individuals and their specific problems rather than with groups and the development of common interests. His interest in group methods, therefore, is indirect. In so far as he knows the principles of leadership, he can make recommendations to the supervisor which are consistent with the training which supervisors receive. It is more important that he be able to recognize and analyze good leader-

ship than that he practice it. Thus, he should have a knowledge of this subject, but need not have developed the skill himself.

If his company has a standardized training program for supervisors, it is important that he know the nature of the training. As a third party, he is in a position to evaluate objectively the effect of the training program, both on the supervisors and on the employees.

ATTITUDES AND MORALE

The psychology of attitudes is of particular importance to the counselor because attitudes are, to a large degree, individual matters. His knowledge of the attitudes of an employee will be gained indirectly from the supervisor's report and directly from an interview with the employee. He must be aware of the fact that a supervisor's report is often an interpretation and that his description of events is influenced by his attitude. Since the conflicting employee and supervisor attitudes may obscure the actual conditions, the counselor may find it necessary to untangle the real events from their interpretations. The kind of coloring the attitudes add to the facts gives the counselor some idea of the degree to which attitudes have created the problem.

To obtain pertinent data from the employee, the counselor must be a trained interviewer. He should be able to get employees to talk freely. This means that he must be able to gain the confidence of individuals. To obtain confidence, he must be friendly and sympathetic. Early in the interview he must show that he and the employee have a common interest — the solving of a problem. He should never be shocked or show disapproval; otherwise, he will immediately block free expression on the part of the employee. If he himself talks too much, he will guide the interview along channels he regards important. In this way he may miss the important source of difficulty. He, therefore, must be a skilled listener and let the employee determine the subjects which will be discussed. Rambling interviews may be very important,

because the most pertinent worries may be suggested when the subject matter discussed is not too limited. When a discussion is too well organized, the subject matter, rather than the emotional background, influences what comes to mind. The end of an interview is particularly important. Often, when the employee is at the door and is leaving, he may remark, "And another thing . . ." This may be the big thing, and the counselor must be hesitant in closing the interview. This remark may be the lead into an important area, the real source of an attitude.

Interview data have most value in that they reflect the attitudes of the employee. The factual material reported may be incorrect and colored, but it is this coloring that displays the nature of the attitude. If the interviewer becomes absorbed in accurate fact-finding and disagrees with certain statements, he not only loses the employee's confidence, but becomes so engrossed in the facts that he overlooks the value of this coloring for the understanding of attitudes. Pointing out contradictions likewise blocks the free expression of attitudes.[1]

Although morale is a kind of attitude, it is more a group than an individual condition. If certain attitudes persistently come to his attention, the counselor becomes aware of the fact that he is dealing with group, rather than with individual, problems. When group trends occur, he is in a position to make recommendations concerning the work situation. A company that is interested in employee morale may use the findings of its counseling service as a barometer of morale. His findings may be considered an important by-product of a counseling service.

FRUSTRATION

Many individuals who seek advice and counsel are poorly adjusted emotionally. For this reason the counselor should have a good background in the psychology of frustration. A knowledge of this subject is helpful in the recognition of maladjusted indi-

[1] For further reading see W. V. Bingham, and B. V. Moore, *How to Interview*.

viduals, as well as in guarding against situations which are conducive to frustration. When frustrations go back to an individual's early life, they are more difficult to handle, and a number of interviews spaced at weekly intervals may be desirable.

When dealing with frustrated individuals, therapy may take a number of directions. The frustrating situation may be corrected, the individual may be helped to interpret the situation more constructively, he may find relief in harmless aggression, and he may gain relief in the process of expressing himself.[2]

(1) *The situation may be corrected.* A loan, a discussion with the supervisor, the granting of a denied promotion, a change in jobs or supervisors, or a transfer to a new locality may remove a persistent source of frustration. A wise counselor may also make constructive suggestions in regard to an individual's personal life. By helping a person to decide on a divorce, by making suggestions in connection with budgets, loans, and housing, by offering help in dealing with a problem child, or by giving advice which will help young people with their emotional problems, he may help to correct situations in which lie background sources of frustration. However, we must point out that only a highly capable counselor should offer suggestions. One who is untrained or biased is incapable of telling others how to live wisely. When a counselor does give advice, he should suggest alternatives and so arrange the situation that the individual in question shall make his own decision. The individual should always make the choice, but the counselor may bring possibilities to his attention.

(2) *Helping an employee reinterpret a situation* is another approach which is open to the counselor. For instance, he may point out to an aggrieved employee that a certain company practice which may work a hardship on that particular employee was not directed at him, but was designed for employees in gen-

[2] The reader may find the following books of interest: C. R. Rogers, *Counseling and Psychotherapy*, D. Katz, and R. L. Schanck, *Social Psychology*, and F. J. Roethlisberger, and W. J. Dickson, *Management and the Worker.*

eral, thus giving the employee a new interpretation of the facts. Frustrated persons have set attitudes and interpretations, and the skilled counselor may help them to see that, in most cases, many interpretations are possible. Often, the mere verbalizing of his problem helps the employee to see it in a broader perspective.

Many of our problems depend upon the way in which we view a situation. For such problems it is not necessary to find solutions, since they cease to exist when we look at the situation from a different point of view. For instance, a salesgirl may experience a persistent source of irritation in the insults she must take, from time to time, from her customers. However, if she can take the view that a certain percentage of customers are abusive and that the abuse is not directed at her personally, she will accept the insults as part of the varied experiences she must expect on the job and will not be irritated. As a matter of fact, she may even be made to realize that a stranger cannot lower her social status. Further, if she can come to regard the abusive customer as a problem, she may even accept the challenge to find out whether or not she is skillful enough to handle such a customer and send him away impressed with the service she can give.

(3) *Harmless aggression also affords relief,* yet does not injure another person. The letter we write, telling someone what we think of him, need not be posted. Before we write it, we have pent-up emotions, but, once these have been expressed, we are relieved. In the same way, the employee's free expression of his grievances to a counselor who is a sympathetic listener serves as a source of relief. Since the counselor must keep such outbursts confidential, the expressed feelings of disapproval on the part of the employee remain harmless.

Often, employees' feelings are repressed because "the customer is always right," and they cannot talk back. Talking back would be harmful aggression, but such behavior as giving another employee a wink which meant "that old so-and-so" might be made

a substitute for the overt aggression. The counselor might very well aid employees in developing such reliefs.

A good counselor will be sympathetic with employee frustrations and will encourage employees to relieve themselves of their repressed burdens. In this way, he can make a very important contribution to employee morale.

(4) *Verbalizing one's own feelings* has a number of beneficial effects. As pointed out above, the expression of one's problems may lead to new interpretations and serve as an avenue of relief from frustration. In addition, the verbalizing of our problems brings to attention many hidden factors. For instance, I may feel depressed without knowing exactly why; so I may blame the weather, or I may blame some person for my feelings. If I talk about my depression, I remove attention from it and seek the factors which led to the condition. If I can find the cause (for example, a letter I received from some person telling about his great success), this discovery influences my mood. Our moods are often influenced by conditions which appear to be unimportant and go unnoticed. Examples of such conditions are lack of rest, little duties or worries, a disagreeable experience on the streetcar, cold coffee for breakfast, and the like. Instead of thinking of them as causes, we forget about them and locate the cause in some later incident, such as in the sarcastic remarks of the supervisor. The telling of the whole story often brings these other factors to attention and places them in their proper perspective.

The value of reliving an earlier experience is that it brings to one's awareness many of these overlooked conditions. The verbalizing even of childhood experiences makes us see these experiences from an adult point of view, and we can then see factors which we overlooked at the time the experiences occurred.

Verbalizing is a means of bringing together details that may have escaped attention. When we put the problem into words, many details are recalled and made conscious. The situation is similar to that of reporting dreams. In telling about a dream,

we discover many missing portions, and the dream becomes less terrifying and less real when we find gaps. Likewise, if we try to tell about our chain of misfortunes, we may discover gaps here, too, and find that the belief that we are always unlucky seems less real than we had supposed.

Verbalizing our wishes and desires helps also to dispel our worries and fears. In this fact lies a psychological value of prayer. The vague, unfulfilled desires bother us more than those which are specific and real. We can face facts better when they are clear than when they are vague possibilities.

As in medicine, the method of prevention can solve more emotional problems than can therapy. The counselor may contribute a valuable service by being on the alert to discover the reactions of employees and by making constructive recommendations to management. He is in a position to know how individuals feel about certain practices and can give management insight into the employees' viewpoints.

INDIVIDUAL DIFFERENCES AND HUMAN ABILITY

Since the counselor deals with individual adjustments, he must be interested in differences between people. Since he may often wish to recommend that an employee be placed in work for which he is better suited, he should have considerable knowledge of this broad and important area of psychology. The more he is grounded in this subject, the better will be his vocational advice.[3]

MOTIVATION

Without a knowledge of motivation, the counselor is handicapped in his understanding of differences between people. The

[3] For detailed treatments see M. S. Viteles, *Industrial Psychology*, pp. 83–322; J. Tiffin, *Industrial Psychology*, pp. 1–184; E. B. Greene, *Measurements of Human Behavior*, and S Rosenzweig, L. E. Bundas, K. Lumry, and H. W. Davidson, "An Elementary Syllabus of Psychological Tests," *J. Psychol.*, 1944, *18*, 9–40.

choices which people make cannot be evaluated without considering their needs. A counselor must be sensitive of the needs and desires which motivate people.

Many employees aspire to advance. Some aspire to positions they cannot effectively handle because they wish the prestige which goes with the position. Others, who are capable, have ceased to try or are too readily satisfied. One's adjustment to the work situation depends greatly upon the relation between his level of aspiration and his ability. The counselor, therefore, will be particularly interested in the psychology of the level of aspiration.

The factors of motivating persons on the job concern the counselor only indirectly, since he is not in a position to determine them. His interest in these phases of motivation, therefore, is largely a matter of increasing his understanding of employee problems.

FATIGUE, BOREDOM, ACCIDENTS, AND TURNOVER

The other topics treated in the text serve mainly as background material for the counselor, since he cannot directly influence company practice in dealing with the problems of fatigue, boredom, accidents, and turnover. A knowledge of these subjects, however, may aid him in interpreting employee grievances and in making recommendations to management. In so far as he can influence employee attitudes and the manner in which they affect these problems, he can make a contribution; but, in general, these problems have to do with the situation rather than with the individual.

Although employee-counseling may have an influence in reducing turnover, the counselor's interest begins before the state of separation is reached. He may, however, gain much valuable information if he is given the duty of interviewing all employees who separate themselves from the company.

HIGHER LEVELS OF MANAGEMENT

TYPE OF LEADERSHIP

Higher levels of management have fewer direct contacts with supervisory problems than do first-line supervisors, and their duties in this area are more abstract, in that they must decide on general policies and practices. In so far as a lower level of management reports to them, higher levels of management can practice a type of leadership with those directly under them, but the group that reports is relatively small and misunderstandings do not arise as frequently in such a group as in the case of rank-and-file employees. Nevertheless, higher levels of management do have an area in which they can put into practice a knowledge of human beings and thus influence the degree to which their immediate staff co-operates.

With respect to their duties as policy-makers, higher levels of management are interested in the type of first-line supervision that is put into effect. Higher management determines the type of first-line supervisors to be selected as well as the type of training these supervisors will receive. A knowledge of the effects of different types of supervision, therefore, will influence the methods and practices that will be encouraged. From this point of view, higher management should have a knowledge of the essentials of supervision, but need not attain the skills. The discussion of leadership in supervision is important to higher management primarily because it gives a basis for criticism as well as a background for evaluating first-line supervision.

ATTITUDES AND MORALE

With the realization that employee attitudes and morale are caused, higher levels of management will tend to seek remedies for unfavorable attitudes and to encourage practices that are conducive to co-operation. Union activities are influenced by employee attitudes, and dealings with the union are primarily in the

hands of the higher levels of management. In these dealings such management has direct experiences with rank-and-file attitudes. If some of the problems can be prevented by practices which make for more favorable attitudes, and if grievances can be detected before they reach large proportions (by means of methods for measuring employee attitudes), much can be gained in establishing better labor relations.

Higher management is concerned, therefore, with the psychology of attitudes and the methods of attitude measurement. Whether or not a disgruntled employee is voicing a personal problem or is representative of a group opinion influences the stand management will take in a controversy. When grievances are rather general, they will be respected even though they may seem unimportant to higher management. What is important to an employee must be learned from employees; it cannot be discovered by higher management's own thinking on the subject.

Higher management must also recognize that favorable and unfavorable attitudes toward the company determine the way employees will interpret incidents. A poorly adjusted employee may gain the support of other employees in case of difficulty with the company if the latter have unfavorable attitudes, whereas other employees may exert social pressure on an individual by laughing off his grievance if their attitude toward the company is favorable.

Knowing that background conditions in the plant influence attitudes, management will make an effort to put into practice working conditions which encourage favorable attitudes. Recognizing that the background conditions may extend beyond the working environment, it will appreciate the value of a counseling service, employee loans, retirement plans, medical and hospital insurance, and the like.

FRUSTRATION

A knowledge of frustration is helpful in making higher levels

of management aware of the importance of good supervision and counseling. More important, however, is an appreciation of the rôle which frustration plays in labor and political movements. Frustrated individuals are readily organized and led, and their activities are militant in nature. Such individuals may be attracted by a union leadership which has aspirations other than improving the working conditions in a given company. A few backward industries in a community may influence, by their employee practices, the kind of union activity which will prevail in that area.

Poorly adjusted individuals are inclined to be militant and seek the union which suits their inclinations. Even when such individuals are employed by progressive companies, they actively seek grievances and cease to be representative of the employees as a whole. In this manner the backward companies aid in the creation of grievances which progressive companies must face. However, the number of employees who have grievances depends on the kind of labor relations exercised by the company which employs them, and a limited number of militant individuals does not influence the staff as a whole.

Satisfied employees are likely to be affiliated with unions which have goals as objectives. With such unions a progressive company may bargain constructively. The mere fact that employees join unions does not mean that they are dissatisfied. If unions can aid employees in gaining security, improving their way of life, and bringing about social legislation, it must be expected that employees will seek to further their personal interests. That they attempt to further their interests does not mean that they are frustrated. To experience active interference in the attainment of objectives, however, leads to frustration, and this condition changes the course of union activity.

INDIVIDUAL DIFFERENCES AND HUMAN ABILITY

The problems of employee selection, transfers, standards of

work, and the like should be handled by experts in human measurement. However, since the higher levels of management determine the degree to which these measurements will be made, a general appreciation of the importance of these subjects is important to them.

Executives do engage in the selection of men for promotion. In making such selections, they must evaluate or rate ability, and their judgments are influenced by all the errors associated with the rating method. Therefore, they, as well as first-line supervisors, are interested in the methods of overcoming errors in rating and in the kinds of variation in human ability.

MOTIVATION

The methods of remuneration and promotion are determined by management. How different methods of pay influence job performance and job satisfaction necessarily must influence its decision on the kind of pay plan which it puts into effect. Employee reactions to wage schedules, therefore, become an important consideration for higher levels of management.

Likewise, executives must be aware of other than monetary needs among employees in order to interpret accurately the demands they may make through their unions. Management is too likely to assume that high wages and short hours constitute the whole of employee needs, when, as a matter of fact, they are not as important as some others.

It is not the nature of employees to want to do the least for the most. It is just as natural for them to want to do a better job than is expected of them. Which behavior is expressed depends upon conditions outside the individual.

FATIGUE

The efficient use of human energy is an important problem for management. Rest pauses and shorter work-weeks have largely come about through pressure from labor, yet these could just

as naturally have been advocated by management. Production falls, and accidents and errors increase, with fatigue. Methods of staving off fatigue are directly linked with efficient production. Much is already known about fatigue reduction, but each industry has special problems which it may wish to investigate, because the method of fatigue elimination varies with the kind of work—that is, whether it is heavy or light, slow or rapid, attention-demanding or automatic, and repetitive or variable. The age and sex of the employee also must be considered.

Fatigue reduction not only improves employee attitudes, but also produces higher work efficiency when attitudes are already favorable. The progressive manager should be interested in fatigue control even when employees do not demand it. Since recovery from fatigue takes place at a slower pace as fatigue increases, it is desirable to consider fatigue reduction before the person becomes aware of fatigue.

PSYCHOLOGICAL FATIGUE

There are many forms of fatigue and the correction of conditions are often specific to the nature of the fatigue. For some, a change is as good as a rest; for others, this is not true. For some kinds of fatigue, a constant pace is desirable; for others, a variable pace may be more desirable. A realization that fatigue is a complex phenomenon, and that behaviors which are sometimes regarded as laziness, poor attitudes, or carelessness may be caused by psychological fatigue, will lead to better employee relations.

It is also important to recognize the relation between motivation and fatigue. Many fatigue symptoms can be corrected by improving motivation and morale. The reverse is true also, since fatigue influences morale and hence the degree to which individuals can be motivated.

ACCIDENTS

The methods of accident prevention, the penalties applied for

failure to use them, the method of introducing safety measures, employee training, and accident analysis are largely matters of company practice. The degree to which a company concerns itself with these problems depends upon an understanding of the causes of accidents. Knowing that some individuals are more accident-prone than others suggests the need for placing the least accident-prone individuals on the more hazardous jobs. That fatigue and lighting are factors in accidents suggest remedies which the company may make.

A real problem is to induce employees to use the safety measures which are available. Too often there is an inclination to blame and criticize employees for failure to use the prescribed precautions. This attitude does not correct the practice. A more constructive approach is to find the reason why certain precautions are ignored or actively avoided. Carelessness, forgetfulness, poor morale, the discomfort or unhandiness of a safety device, and poor training all are different reasons, and all have different remedies. The mere adoption of safety devices on the part of management does not solve the accident problem, because it overlooks the human factor. Higher management must have a real appreciation of the human factor in accidents in order to concern itself with a progressive accident-prevention program.

Most managers are aware of the direct costs and the human suffering which accidents produce, but often they overlook the indirect costs. The indirect costs include the expense of training substitute workers, the increased hazard resulting from unskilled replacements, poor morale, social disapproval, and the like. Most authorities regard the indirect costs as greater than the direct ones.

JOB ENVIRONMENT

Higher management, alone, is in a position to correct lighting, improve ventilation, install sound-proofing, and improve the physical appearances of a plant. These factors should not be

overlooked because they affect work both directly and indirectly. The direct benefits arise because certain environmental conditions are basic requirements for the work. Inadequate lighting is equivalent, in effect, to making people partly blind; and noise is the equivalent of partial deafness.

The indirect benefits of a good job environment are the reduction of fatigue and the improvement of morale. The degree to which a favorable job environment will improve work must be set against the cost of such improvements. This problem can be decided only after a proper consideration of the pertinent facts.

LABOR TURNOVER

Dissatisfaction is one of the many factors in labor turnover. Dissatisfaction depends on an employee's suitability to the job, his opportunities for advancement, economic considerations, the type of supervision, and many of the other factors associated with morale. Whether or not the dissatisfaction leads to turnover depends upon the degree to which more desirable jobs are available. This latter condition is not under the control of higher management, but a company's policies and practices may influence job satisfaction.

The costs of labor turnover are apparent to management when turnover is extreme, but often the costs incurred in having dissatisfied employees are overlooked, particularly when the labor supply is plentiful. The very fact that labor turnover is unnecessarily high during a war suggests that a sense of loyalty and responsibility has not been developed in many employees. Since loyalty and responsibility are personality characteristics that are developed in certain situations, it is important for management to appreciate the degree to which it can influence their development.

Despite the efforts of management, turnover will vary with the times. But the degree of turnover will be different for different

companies even when labor supply and wages are equated. Detecting dissatisfactions before they reach the stage of individual grievances may reduce turnover for the same reason that recognition of group grievances prevents strikes or organized restrictions of production.

THE PSYCHOLOGICAL ATTITUDE TOWARD HUMAN PROBLEMS

Emphasis in this volume has been placed upon methods which encourage co-operative effort and a meeting of minds. It is just as human for people to co-operate as it is for them to oppose one another. Whether co-operation or opposition occurs depends upon the kind of situations they face. For this reason we have placed more emphasis upon the creation of favorable situations than upon the changing of human nature.

The psychologist's purpose is to discover the nature of man and, once it is known, to make the best possible use of it. For instance, we have discovered that man is so made that he resents an interruption. This resentment may be regarded as undesirable, but, if we make use of it, we discover that it has a virtue, because this same trait makes a man want to finish a task once he has begun it. We likewise have discovered that an individual, by nature, has more aptitude for some kinds of work than for others. The obvious application of this knowledge is to fit the individual to the job requiring his particular aptitudes, rather than to attempt to change the man to fit a given job.

We know other things about men: they like to participate; they get bored; they have pride; they are social beings. The traits implied in these statements may be undesirable in work situations. However, it is a fact that the traits exist. The psychologist accepts this fact and tries to construct the work situation so that the traits cease to be disadvantageous; actually, they can often become advantageous. For instance, in a certain company, men do not like to clean and check terminals because there are thousands to be gone over and there is never an end in sight. This

is a fact that should be faced. The clever foreman, therefore, divides the terminals into blocks, and labels each set with a ticket. Now the employee is free to choose a block of terminals to work on. He removes the ticket from the block he selects and has a unit of work which has an end to it. The result is that there are no more complaints of boredom, and each individual strives to leave no unfinished units at the end of the day.

Once we know certain principles of behavior, we can adjust work situations to conform more closely to the nature of man. We cannot successfully solve problems in human behavior by trial and error, because in such a procedure we do not have the correct principles to guide us. Nor can we solve them by logical analysis. For example, we may feel that a person who is unpopular should be more co-operative and thereby attain the friendship of others. However, should we tell him this, he may construe it as criticism, at which he is likely to become resentful and consequently act contrary to our logic and become even less co-operative than he was before. It is because neither trial and error nor logical analysis works in the understanding of human behavior that psychology has become a strictly experimental science.

Man strives to maintain his pride and gain the respect of others. If he finds that he happens to be right in an argument, he likes to inform others of the fact, assuming that this will win respect. "I told you so" is a common phrase. The Orientals have discovered the anti-social aspects of such a statement. They have developed a great respect for the practice of "saving face." There is a story about an American who was traveling in China.[4] He wished to buy a ticket at the station, but the ticket window was closed and it was apparent that a gambling game was in progress inside. He had to board the train without a ticket. With a ticket the fare was eighty cents, but, when purchased on the train, the same fare was one dollar. When the conductor came for the fare, the man argued that he should pay only

[4] E. M. Poteat, "Face," *Harper's Mag.* 1945, Feb., 262–263.

eighty cents because he should not be penalized for the railroad company's negligence. Passengers and conductor agreed that this was reasonable. The conductor pointed out, however, that he had to turn in one dollar for the fare he sold and that he should not be penalized for the company's poor service, either. His point was also plausible and was so recognized by the interested passengers. Now neither could give in without admitting the other had the better of the argument. This amounted to "losing face." The problem was solved without anyone's "losing face" when another passenger borrowed twenty cents from the American and quietly gave it to the conductor. The passengers were pleased with the solution.

We may think that it is childish to make such a ritual of "saving face." Nevertheless, we, too, hold out on similar matters and talk eloquently about the principle involved. The desire to "save face" is a trait in man that we must recognize; when we respect it, we shall better understand our fellow-men. Consider how both parties of a labor controversy claim a victory in a strike settlement. Should not all settlements respect the need of both parties' "saving face"?

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